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FRONTISPIECE.

[Jas. W. Reoch.]

THE LAST OF THE POLLOK WYCH ELMS.



nnals

OF THE

Andersonian Naturalists'
Society.

VOL. III.

GLASGOW:

PUBLISHED BY THE SOCIETY.

1908.



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NOTES ON THE TRAP-FLORA OF RENFREWSHIRE.

BY G. F. SCOTT ELLIOT, M.A., B.Sc., F.L.S., F.R.G.S.

(Read 4th September, 1903.)

THE district which is referred to in these notes is that part of Renfrewshire and Ayrshire which lies in the triangle between the two G. & S.-W. Railway lines to Greenock and to Dalry respectively, and of which the base is a line up Noddsdale Glen.

The rocks are composed mainly of porphyrite, melaphyre, etc., and are interbedded (according to the geological survey) in the shales, cement-stones, and grey sandstones of the Upper Old Red Sandstone.

They are the result of a series of gigantic lava flows, originating somewhere in the north-west, and probably from an ancient volcano, now submerged, somewhere between Helensburgh and the Cloch lighthouse. They are most frequently exposed in a series of cliffs or escarpments, which run usually from east by north to west by south, but many are nearly due north and south. Intrusive felstones and porphyrites occur, and sometimes tuff replaces the porphyrite and melaphyre.

Towards the east there are necks and dykes of Miocene basalt, but there are none in this district.

Thus there were two periods of volcanic activity—one in the Upper Devonian and the other in Miocene times.

These outbreaks are separated by an interval of time much greater than that which has elapsed between the last and our own days.

The district has been much altered by ice action. It seems to have been the converging point of the northern or Highland and southern or Galloway ice.

I think that many of the valleys, such as the parallel series of escarpments along the Lochar, as well as that from Carruth to Bridge-of-Weir along the Gryffe, and others, have been largely scooped or dug out by the ice-plough.

At any rate, the lines of cliffs or escarpments follow pretty closely the arrows on the geological map, which show the direction of the glaciation. There is one series showing that part of the ice travelled in the direction from Kilmacolm to Lochwinnoch, and another approximately from east to west, which corresponds with the escarpments of Braes and of the cliffs on the south of the Gryffe valley above Carruth.

The rivers and streams have acted on this roughly outlined and rocky country, producing an extraordinary surface of rough, rocky bosses, outliers or islands of rock, with sloping, grass-grown surfaces above and below; sometimes they look like waves of ground breaking in steep, rocky faces. Except in a few valleys there is no flat ground whatever.

Botanically, the country is very rich. Members of the Society would find many exquisite places for excursions which do not seem to be generally known. The Maisch, Garnock, Calder, Millburn, Bridesburn, Blacketty, Green-water, and Gryffe are good botanical ground, but it is especially in those problems that arise from the presence together of rock, marsh, and natural woodland that it is interesting; and it is with one of these problems that this paper is concerned.

One sees these escarpments or cliffs of rock in every stage of development. Sometimes they are bare and scarcely touched by vegetation. Others are broken into small projecting boulders. Others, again, are covered by rough vegetation. Sometimes, though rarely, they have the same plants as the fields around them, and then they are only recognised by their slope which is steeper than that of the rest of the field.

By studying the various exposures in different localities, it is comparatively easy to see what has happened. The rock faces become gradually covered over by vegetation until, eventually, they are mere slopes barely distinguishable in a field by a steepness and shape which show their origin. The stages of covering may be roughly classified as follows:—

1. The lichen crust.—Bare rocks covered by a nearly continuous film of crustaceous lichens with flowering plants only in the cracks or crannies of the rocks.
2. The moss-moor and rangiferina moors.—More or less combined with cranny plants.

3. *Vaccinium* (blaeberry) and wiry grasses.—From this stage there is a difference in the flora above the zone of cultivation, for peat formation sets in. In the low-lying lands, or zone of cultivation, this is followed by
4. A herbaceous stage.
5. Whin or broom and bracken.
6. Rosaceous stage.

1. *Lichen stage*—(a) Crust lichens.—The commonest forms are *Lecidea geographica*, *L. contigua*, *L. lavata*, *L. lapicida*, *L. rivulosa*, *L. fumosa*, *Lecanora tartarea*, and *Variolaria dealbata*.

The last two appear, in my specimens, to grow over stone that has been already occupied.

These crust lichens are, for some reason, not well-developed. Where they do appear, however, they absorb most of the rain water, which is thus prevented from entering or corroding the rock; they also affect atmospheric weathering in other ways. Dust accumulates on them; the last two lichens form a quite perceptible crust, covering the stone, and of quite an appreciable thickness. The growth is slow. *Variolaria* grew five hundred and twenty micro-millimetres from the 1st February to the end of September.

(b) Leafy lichens.—*Parmelia physodes*, *P. saxatilis*, *P. sulcata*, and *Cladonia cervicornis* are the most important. Though these are found on natural rocks, they are not common. It is on walls or dykes formed of these rocks that they are especially abundant. On such dykes *Physcia parietina*, *P. tenella*, and others occur, and possibly a close search would show them on the rocks also.

These *Parmelias*, and especially *P. sulcata*, are extremely tenacious of their ground. Their growth is about five millimetres per annum. When once established, they spread circularly, and on lifting off the patch, one finds clear evidence that they not merely overgrow their neighbours, but also overgrow *their own remains*. Layers of dead pieces of former fronds are found *below* those that are active, and the younger rhizoids clearly fix themselves on the older branches. Thus the rock is protected not merely by the thickness of one frond, but also by a series of dead pieces. They also act as water-retaining and dust-collecting agents; they also intercept heat, light, etc., and afford shelter to small animals.

The two *Cladonias* (*cervicornis* and *pyxidata* var. *neglecta*) form compact little tufts. On investigating these tufts, one finds a bewildering mass of remnants—remains of the older part of the *Cladonias*, mosses which have begun to grow between them, and fragments of liverworts, etc.

The net effect of their preliminary attack upon the rock is to form a rough surface covered by a more or less thick, firmly attached crust of vegetable lichenic material.

2. *Moss stage*.—Clochodrick stone is essentially in the first period (or crust stage). The second stage is especially characterised by mosses. Of these the commonest genera are *Rhacomitrium lanuginosum*, *R. heterostichum*, *R. aciculare*, *Ceratodon purpureum*, *Dicranum* species. One finds along with these mosses, *Cladonia rangiferina*, *Stereocaulon denudatum*, *Sphaerophoron coralloides*, *Cladonias* various species (*C. gracillis* var. *chordata*, *C. furcata* and its rare variety *spinosa*), *Cetraria aculeata*, etc.

In the more exposed places, *Andraecas* and *Polytrichum* species occur. In the wetter places, *Brachythecium*, *Hypnoids* and *Bartramia pomiformis*, *Diplophyllum albicans* and *Jungermanniaceæ*.

Some of the *Cetrarias*, *Bartramias*, *Rhacomitria* and *Dicrana* are able to form nearly pure tufts without any other plant. This is unusual. Generally one finds complex tufts consisting of many different species, with lichens, mosses and liverworts all mingled together. Very often worms, small insects, animalculæ, fungi (*Agaricus semiglobatus* and *A. hypnorum*), also appear in them. But, whatever the constitution of the tuft botanically, its economic importance is quite extraordinary. The amount of rich earthy material is very great. Exact measurement is almost impossible, because one cannot say definitely where one should begin to measure. The moss stems are often two to three inches high, and the underlying earthy matter may be one inch thick (more or less).

That particular area of the rock is now defended by the tuft from frost; its surface is not dragged off by water. No ablation occurs. The moss stems are like a sponge laid upon it, and even when they are saturated with moisture, the water simply flows over them and does not touch the stone.

3. *Vaccinium stage*.—In this condition the rock affords an opportunity for the plants of the third group, such as blaeberry, heather, *Galium saxatile*, *Potentilla tormentilla* and grasses (such especially as *Aira flexuosa*, *Agrostis*, *Festuca ovina*, *Anthoxanthum* and *Luzula*). At fifteen hundred feet Lycopodiaceæ, the hard-fern, and *Juncus squarrosus* are found.

These plants are probably divided into two groups, which act in different ways. Those which are essentially "cranny" plants fix themselves in some deep crack or crevice, and send out quantities of branches, which grow a short way through the tuft and then turn upwards above its surface. Others, such as *Galium saxatile*, do not seem to care much about a crevice to fix themselves in. They have exceeding long wiry shoots which are buried in the moss, and from these the erect or trailing aerial branches are formed. *Galium* is especially interesting, because there are at least two sorts of aerial branches. Some end in flowers and fruits; others, after forming leaves and remaining above the moss, appear to become, at the end of the season, burrowing colonising shoots. Their tips grow into and hide themselves in the soil. They seem, indeed, to be negatively heliotropic. *Calluna* (heather) also does not seem to care about the rock crannies, and spreads under the surface of the moss. Grasses, in this stage, seem to send their roots down through the humus of the moss tuft until the roots reach the stone, which they probably corrode rapidly.

Blaeberry is especially interesting. Sometimes it is distinctly a cranny plant. I have seen a specimen with a stem half an inch in diameter, which had grown deep into a huge, detached, apparently quite solid, block of stone about two and a half feet thick and three feet high. But the blaeberry also forms horizontal pink shoots, which grow through the moss humus and no doubt take root.

Thus the stone is exposed to two distinct destructive influences—the wedging and breaking-up effect of the cranny plants, and the corroding action of the grass roots and others on its surface.

The development of this third stage is extremely interesting to study. On watching closely one often finds that the surrounding vegetation grows over the rock like a sort of vegetable wave.

Next the rock is a thin layer of dead peat covered by white or grey lichen ; a moss tuft comes next, and, through the mosses, stems of grass or blaeberry appear.

4. *Herbaceous stage*.—At the end of this third stage (in the case of these rocks on the lower ground) we find the fourth stage beginning.

In situations such as are these rock slopes on the low grounds, sphagnum does not set in. The growth of the herbaceous plants is aided by the disintegration of the rock, and also by rock-falls, and by rapid drainage. The net result is the mixture of the moss humus with sandy, stony, and other particles, and the formation of a very steep slope. The vegetation covering it is very thick, and a *close* not an open one. A whole series of plants can develop under these conditions. The most important are—*Scabiosa*, *Galium verum*, thyme, bluebell, *Hypericum pulchrum*, *Teucrium*, *Meum*, violas, etc. All the plants of the *Vaccinium* group maintain their ground except *Calluna* which generally vanishes. Some of the above list, notably *Meum*, have special preferences. *Meum* prefers the edge of a buried escarpment, where its long root stock can pierce deeply into the rock. The crown is protected against cold, heat, and drought by the extraordinary bushy rosette of dead leaves.

5. *Ulex stage*.—The fifth stage (leguminous and bracken) consists of whin and broom. The plants, when young, are often crevice plants, and quite inconspicuous, but, as they grow older, they branch out so as to overshadow and kill out most of the grasses. Practically any one of the fourth group may occur amongst them ; many others are also found, *e.g.*, *Rumex acetosa*, yarrow, *Holcus*, and other grasses, and also invading plants of the ordinary meadowland around them, such as ragweed, clovers, thistles and buttercups.

Bracken is very characteristic of this stage, and also of the following. Its distribution is very peculiar. Generally it is at from four to five hundred feet altitude, and, I think, its presence is governed mainly by the exposure. Wind, I fancy, prevents bracken developing unless it is protected by other plants.

I have this year seen the destruction of a very old whin-thicket, consisting of plants apparently five feet high, with woody stems often three inches in diameter or more.

6. *Rosaceous stage*.—About this time there appear in the whin and broom thickets the first invaders of the sixth or Rosaceæ stage.

Roses, hawthorn and rowan are the commonest; then brambles and sloes (latter not so common). Amongst them, foxgloves and, occasionally, ashes show that if left alone a wood might develop. Woods, in fact, do grow luxuriantly on those faces which are too steep and broken for the plough, as may be seen everywhere in Renfrewshire. Nor are they necessarily of any one kind. A beautiful example occurs near Kilmacolm, above the Gryffe, on the steep slope. Pines also grow on them well (with bracken); so also do oaks and mixed deciduous woods, with a luxuriant woodland undergrowth; beech occurs when planted, and has often a homogeneous *Holcus* wood-floor.

Altitude has nothing to do with this distribution. I drew out a list of characteristic plants noticed in twenty typical localities (see page 10), and found that there were very few, comparatively, which could be held characteristic of any altitude.

It is true that the "Summit" or *Vaccinium* flora from 1,500 to 1,700 feet (Robber Craigs, Misty Law, Hill of Stake, East Girt Hill, Boxlaw and High Corby Knowes) differs in the presence of the Lycopodias and *Juncus squarrosus* and the absence of many plants common below; but then I have no doubt that we could find all the others if the highest hills were four or five thousand feet. It is not altitude in feet above sea level, but exposure to wind, snow and heat, that keeps out these lower plants.

On the Alps, five species, according to Vaccari, reach 4,200 metres, *i.e.*, 13,000 feet. Lichens occur elsewhere at 6,010 metres, and *Saussurea tridactyla* at 19,000 feet. Even the beech may ascend higher up the mountains than the oak. It is not mere altitude, but the conditions of rain and climate that affect this flora.

The "summit flora" represents an arrested development.

In that rainy and exposed situation, after the *Vaccinium* (3), sphagnum appears, and covers or chokes out all plants which are unable to adapt themselves to the new conditions.

Cottongrass, *Erica tetralix* and *E. cinerea* and *Scirpus cæspitosus* would be the next stage (with *Cailuna* and lichens or blaeberry growing on any dry patches).

Then would follow the "primæval peat" plastered over the higher summits.

The point, however, is that the characteristic rock-face flora will not occur.

Certainly these Renfrewshire rock faces have a characteristic association. As members of the Society are aware, there is, as yet, no recognised law as to associations and formations. Practically every botanist follows his own views.

Eugen Warming divides the vegetation into some thirty-three distinct associations according to the moisture conditions. Thus we find a reference to the *Ulex* association under the heading of xerophyten shrubs. Under the rock vegetations there is a note of the lichen heaths of the far north, and moss-moors come under water vegetation. Woods under mesophytenvereine.

But as I have shown, the same plot of ground may be successively inhabited by five or six of Warming's associations.

A. F. W. Schimper starts from quite another point. Taking the three great climatic divisions—wood, grass, and desert—which depend like those of Warming on the amount of water in the soil and atmosphere, he finds in each of these great divisions, formations which are governed by the chemical and especially physical conditions of the soil, or "edaphic" conditions.

But he says that the formations are not in themselves uniform, but show gradations which are due to special climatic conditions.

I think you will at once see how very difficult it is to find the place of any special case, such as our Renfrewshire rock flora.

During the history above described, it is successively covered by five or six distinct and different associations (Warming's) viz. :—

1. Lichen moor. (*Xerophyten* or *rock-floors*.)
2. Moss moor. (*Polytrichum*, *Hypnoid*), *Hygrophyten*.
3. *Vaccinium* stage. *Alpine meadows*.
4. Herbaceous stage. *Grass meadows*.
5. *Ulex* stage. *Xerophyten shrubs*.
6. Rosaceous stage. *Mesophyten shrubs*.

Nor is this all. Two of the plants concerned, namely, broom and whin, pass *during their own life-history* from a wet association to a dry one.

Young plants of both show the trefoil leaves, and compete with grasses and ordinary flowering shrubs. Later on they are above the grasses and lose these trefoil leaves, becoming either (broom) leafless or (whin) spiny leaved. Both are xerophytic finally, but at first mesophytic.

What I think both Warming and Schimper scarcely appreciate is the change that is always at work in all vegetation. They look simply to the present plant covering, and so classify the world's vegetation by its present condition, just as, in a geological map, one simply takes the surface rock.

It would be, I think, more scientific and more easy to carry out the geological comparison a step further. We have, in these rock faces, outliers of the previous vegetation of the country.

In the rings of different plants round an exposed boulder we have an exposure of the successive vegetations. We can see before our eyes not merely what is going on now, but what has possibly happened all over Britain since the Ice Age.

Then, no doubt, the lichen-moors and moss-moors covered square miles of country, as they do in the far north to-day. There was probably a *Vaccinium* or moor state, and after this came broom and whin, followed by roses, which again was followed by woods.

It is quite unnecessary to suppose great changes of climate. A dry, warm, steppe-like climate is assumed by Magnin to have marked the close of the Ice Age. This is quite unnecessary. The conditions would only permit dry plants like whin and broom to grow.

At any rate, that is my present opinion ; and this conception of the rock faces as showing the stages by which bare, bald and rugged rocks are changed into peaceful, grassy lowlands or fine beech and oak wood, seems to me well worth close investigation.

THE COURSE TAKEN BY FOOD MATERIAL
FROM
LEAVES TO DIFFERENT PARTS OF THE STEM,

BY ISABEL J. HUNTER.

(Read 3rd July, 1903.)

ONE reads of a German poet who, when asked why he was so fond of walking in the fields, replied that he delighted in hearing the plants grow. It is not given to every one to have so acute a sense of hearing, nor, were other sounds to be heard in proportion, would one envy the German his possession. But, though denied the poet's privilege of hearing the plants grow, we may be pardoned if we have a not unnatural desire to learn what we can about their growth.

That much is already known goes without saying, but if it were not a marked trait of the human character ever to set a higher value on what is not known than on what has already been made manifest, there would be no such thing as ignorance.

Therefore I do not purpose to treat of facts already within our grasp, but of one which the work of others has brought within our reach. I refer to tracing the direction and measuring the rate of the food current in plants.

Botanical research has sufficiently demonstrated that it is within the green cells of the leaves that this current has its origin, and that it travels by the bast tissue to wherever growth is taking place, or food substances are being stored for future use. But though many have succeeded by the use of coloured fluids in determining the direction taken by the sap ascending from the roots, evidently no one has hitherto thought that it might be possible to show with equal clearness the direction taken by the descending sap.

The green cells of the leaf are sometimes compared to factories to which the raw materials are transported, both those entering

from the soil and those absorbed from the air, to be there manufactured into organic substances such as the plant can live upon.

That the bast tissue is the medium by which the sugar and other food stuffs travel from the factories to the seats of consumption is evidenced from the fact that when the contents of the phlœm or bast cells are tested they are found to contain the same substances as are formed in the leaves, and also that if an incision is made round a branch, and a small ring of tissue be removed extending inwards as far as the wood, the growing parts below the wound dwindle and die, while those above become more luxuriant. Thus, though we know where the food stuffs are manufactured, by what medium they travel, and their destination, yet the exact course followed and the rate of travelling are not known, and it was with the view of determining these that the following experiments were undertaken. Most of them were carried on in the Botanical Laboratory in connection with the Technical College, and under the guidance of Professor Scott Elliot, to whom I am indebted for suggesting methods of conducting the experiments, and also for the sympathetic and helpful interest which he has shown.

Several methods were tried, but the following was found to be the most successful. The idea was to discover whether it was possible to insert a coloured fluid into the food-conducting tissue of stems and leaves, and whether the course followed by the food material could be studied by the use of such a fluid.

Both pot plants and cuttings from any available evergreen trees and shrubs, such as laurel, rhododendron, pine and box were employed. My choice was limited to these, as the experiments were made during winter and early spring.

The method of conducting the experiment was as follows :—

Eosine was inserted into a puncture made in the stems and on the under side of the midribs of the leaves by a fine needle. The object is to pierce the bast or phlœm only, leaving the xylem or wood uninjured. But as the extent of development of cortex, bast, and xylem differed in the various stems, and as the dye must on no account be introduced into the xylem, it was necessary, first of all, to cut and examine a transverse section of each stem in order to determine how far to introduce the needle, so that the bast would be pierced but the xylem uninjured. After settling

this, a trough of plasticene was formed round each stem about four inches above the cut end, or in the case of the pot plants, round a branch about three inches from its union with the main stem. It is rather more difficult getting the plasticene to adhere to the under side of the leaf and to model it so that the eosine will not escape, but, with a little care and ingenuity, it can be done. To exclude air from the puncture the troughs were first filled with eosine, and then the needle was made to puncture the stem from above, downwards, at about an angle of 45° . Inserting the needle at an angle makes an opening that has several advantages over one made at right angles to the stem. For one thing, it holds more eosine, and, for another, the injury to the plant is not so great. As regards the time allowed, it was found that as the eosine was absorbed quicker and travelled more rapidly in the leaf midribs than in the stems, less time was required for experiments on the former than on the latter. At the end of three or four hours the leaves had absorbed sufficient eosine to show definite results, whereas at least twenty-four hours had to be allowed for stems. After the allotted time, the plasticene was removed, and the stems and leaves washed, dried, and set aside for two or three hours. This is necessary, for if the sections are cut when the cells are flooded with eosine some of it escapes into the adjacent cells, and so spoils the result. When cutting the section great care has to be taken to disturb the eosine as little as possible. All the transverse sections of the different stems, both those cut at the point of insertion of the eosine and others, whether higher up or lower down the stem, showed clearly that the fluid inserted had entered the phloem, diffused from it into the medullary rays of the phloem, from these into the cambium, and also into the medullary ray cells of the wood. From these latter cells it diffused into the water-conducting tissue surrounding the pith. Every precaution was taken when cutting the sections, such as cutting towards the puncture, keeping the razor and stem as dry as possible, etc., to prevent the dye entering the cells which it had not diffused into. As a result, it is obvious that it is possible to insert a fluid into the bast or phloem, and that a fluid so inserted is taken up by the tissues.

To determine the course taken by the eosine, longitudinal, as well as transverse sections, were also taken. From these it was

seen that diffusion takes place slowly in the cortex, and less rapidly than in any of the other tissues. When the colouring fluid is injected into the cortex alone it goes no further, only a few cells surrounding the puncture are coloured, but that is all. This was markedly seen in the case of the box stem. The puncture was full of eosine, and yet not even the adjoining cells were coloured. There was a bright red residue on the stem, which indicated that probably some of the liquid had been absorbed, but the colouring matter left.

When a cork cambium is present, the eosine enters its cells and diffuses from cell to cell. In cross sections the cork-forming layer appears as a red band. This was very noticeable in the section of the laurel stem. Longitudinal sections show that in the cortex the eosine diffuses as slowly in an up and down direction as in a lateral one. The case of *Pinus sylvestris* was very interesting, as in the cortical cells the eosine was found to have diffused more than in any of the other stems. A section cut two inches above the insertion of the eosine showed that it was especially the cells or epithelium surrounding the resin canals which were coloured. In most of the other stems the dye was found to have ascended farthest in the xylem vessels.

In the phloem the eosine was found to have diffused to a greater extent in all directions than it did in the cortex. The distance ascended was in every case less than the distance descended. But until the experiment has been tried on growing plants at different seasons, and the results compared, no definite conclusions can be drawn. From the sections on the table you will see that it is possible to inject into the sieve tubes; and as the eosine when injected at one point only does not interfere with the life of the plant, both the rate and direction of the flow in a growing plant might be accepted as being natural. Other dyes were tried, but eosine was found to be the best.

That the course followed by the food material can be studied by the use of such a fluid seems probable, for besides the sieve tubes and companion cells, the medullary rays are also coloured. These latter extend from between the cells of the phloem across the cambium and xylem to the pith. The contents of the medullary ray cells diffuse into the cells of the cambium adjoining them. That the dye diffuses from cell to cell of the cambium in

a lateral direction is seen from the fact that, in a cross section, the coloured portion of the cambium extends on each side beyond the coloured portion of the phloem. The longitudinal sections show that the dye ascends in the cells of the cambium to the same height as it does in the phloem, but that the distance descended is greater. Transverse sections cut on a level with the point of insertion of the eosine show that the eosine travels along the medullary rays to the pith, but instead of entering the latter, it enters the vessels forming what is sometimes called the medullary sheath. The rhododendron stem showed this well, the medullary rays showing as thin red streaks, radiating from the pith to the phloem. To test or decide whether it were the case that the eosine, and therefore probably the food, enters vessels which are generally supposed to conduct water, eosine was inserted into several stems, and after some of it was absorbed the stems were placed in test tubes containing a solution of saffron. Both the transverse and longitudinal sections show the cortex and phloem stained red, the large vessels and the cells surrounding them yellow, while the vessels surrounding the pith are orange, showing that in these two latter the two currents had mingled. This result was particularly interesting, as the use of the two colours gives a vivid picture of the course followed by both the ascending and the descending currents—the eosine showing the course of the food from the leaves, and the saffron that of the water from the roots. From these experiments it is evident that eosine inserted into the cortical and bast tissue of stems travels by the phloem, medullary rays, and cambium, all of which consist of living cells. In one or two of the sections on the table you will notice that in one or two places the tissue next to the pith is very brightly coloured, showing that the stream has been directed towards these points. This seems curious, but in the stems which I examined I found that the increased flow was directed towards places where buds were developing. The section of box stem shows this clearly, but not so much so as when I sectioned it. Then, the outer tissue showed pure white, while the cells of the bud and those leading to it were turgid with eosine. This result was the more remarkable, for, as previously mentioned, when the eosine was inserted into the cortex of this stem none was absorbed. This coloration of the protoxylem was found in all the stems examined; and as in the

case of the box, so with the pine, rhododendron, and laurel, the current in these vessels was found to be directed downwards towards developing buds. But as the experiment was made on the upper and younger portions of stems, I cannot say whether this would also happen in older portions.

I have treated of the stems first, chiefly because there was more uniformity in the course followed by the eosine in them than in the leaves. The extent of development of the different tissues being greater makes it easier to experiment on stems, and also to observe the results. But as one would naturally, if he were trying this experiment on a growing plant, think of injecting into the leaves, I shall state what happened in the cases I tried. At first I inserted the eosine into the green cells, with the result that the cells surrounding the puncture died, and showed as brown spots a quarter of an inch in diameter. The effect produced in a hyacinth leaf was equally disappointing. The eosine was injected one and a half inches from the tip and a quarter of an inch from the margin. The neighbouring cells turned flaccid, but not brown, and no cork was formed as in the case of evergreen leaves. The remainder of the leaf was in no way affected, and as the leaf continued to grow it became contorted at the tip. The eosine has evidently an injurious effect when introduced into cells in which assimilation is going on, but when introduced into the under side of the midrib it has no such bad effect. It is not easy determining how far to insert the needle, but leaves are more plentiful than stems, and are easier to section, and you can always see by examining a section cut at the point of insertion how far the needle has entered. If the eosine enters the sub-epidermal tissue only there is no result. The laurel leaf is an interesting one to experiment on, on account of the living cells which extend in a radial direction between the xylem vessels, so that they are in connection with both the phloem and the xylem. The eosine inserted into the phloem travels downwards very slowly, compared with what it does in the sclerenchymatous tissue outside of the phloem, or in the living cells between the vessels. In the leaves the eosine which enters the vessels from the parenchymatous cells travels upwards. In the other cells the direction is a downward one. When conducting the experiments I did not take notes on the rate of travelling, because it was to be expected that

the eosine would travel slower in cut stems than in growing plants. As a matter of fact, the rate was greater in the pot plants, and in the experiment which has since been tried on a growing plant the rate was greater still. To sum up, the food current in plants is directed towards places where young or undifferentiated cells are being formed and passes along the protoplasmic lines of communication. As I have endeavoured to show, this is the exact course taken by the eosine, so that by injecting it into the bast tissue one may trace the direction taken, and also measure the rate of the current.

RECORDS OF EXCURSIONS IN DUMBARTONSHIRE.

BY JOHN R. LEE.

THE county of Dumbarton presents a pleasing diversity of surface features—shady glens with picturesque cascades and murmuring streams, wild and lonely stretches of moorland, carpeted with every variety of grass and heather, winsome glimpses of river, loch, and mountain scenery, and sometimes all these in combination. This variety of scenery is due in part to the geological nature of the district. The great Highland fault crosses the county from behind Rosneath to a little below Luss, thus dividing off a portion to the north, in which the schistose rocks of the highlands are in evidence; whilst the more extensive lowland portion includes large areas of hill country where the peculiar features of the trap rocks of Carboniferous age are very marked.

The fauna and flora of the county consequently possess considerable attractiveness, and the numerous excursions of the Society to various points within its boundaries have generally been of an interesting nature. In the present account of these excursions the county is, for the sake of clearness, divided into eight sections, and the excursions in each of these are separately referred to.

I.—CUMBERNAULD DISTRICT.

The detached portion of the county extending from Lenzie on the west to Castlecary on the east, has been visited by the Society on five occasions, viz.—13th June and 22nd August, 1891, 29th April, 1893, 10th October, 1903, and 3rd September, 1904. On the first three occasions Castlecary was made the objective, the road from Dullatur being traversed on the third of these. A full account of these three excursions is incorporated in the Records of Excursions in Stirlingshire, which appeared in Vol. II. (pp. 129-131).

The line of the Roman Wall between Dullatur and Cumbernauld was visited on the fourth occasion mentioned, this being one of the fungus forays which have of late years been a constant feature of the Society's programme. The reports, however, indicate that no finds worthy of special note were made.

The last excursion to this district, 3rd September, 1904, was a walk from Croy Station, through Bar Hill to Twechar, returning by the canal bank. Bar Hill forms the western portion of an extensive ridge of igneous rock running parallel with the Kilsyth end of the Campsie Fells, from which it is separated by the valley of the Kelvin. The ridge is broken midway by the gap, through which runs the road from Condorrat to Kilsyth, and which divides Bar Hill on the west from Croy Hill on the east. Although geologically these two portions of the ridge are identical in structure, the scenery presents a marked contrast—Croy Hill being covered with grass and bracken, while Bar Hill is beautifully wooded, affording good cover for the game which abounds, and yielding much valuable timber. There are numerous whinstone quarries in the vicinity, and in many parts of the rock faces an approach to columnar structure was observed. The lateness of the season was unfavourable for botanical work, and nothing of an uncommon nature was observed as regards the flora of the district. The special feature of the woods which attracted attention was the number of large beeches, although there are many fine oaks, pines, and other species as well. The footpath which was followed ends abruptly at the old coke ovens, now disused. The process of coke making, formerly carried on here, has now been transferred to Twechar, a short distance to the west.

II.—MILNGAVIE DISTRICT.

The portion of the county lying between the Allander and the Clyde, and extending from the Kelvin to the base of the Kilpatrick Hills, embraces a district which has received a considerable amount of attention from the various sections of the Society. As, however, no detailed record is kept of sectional excursions, it is only possible to give a brief general account of the large amount of work done in this locality. Dougalston Loch, which is situated partly in Dumbartonshire and partly in Stirlingshire, has been visited on four different occasions by members of the

microscopical section, for whose particular studies its fen-like margins yield abundant material. The numerous small lakes in the Milngavie district have always been an attractive hunting ground to members of the Society—their peculiar flora, as well as the abundance of bird and insect life, affording rich fields of investigation. Most of these lakes, however, are just outside the county boundary, the only other one falling to be dealt with in this account being St. German's Loch, near Bearsden, which has been long known to members as possessing several features of interest, and has been twice visited officially—once by the microscopical section, and once by the botanical section. On one side the characteristic "willow-thicket" is well developed, while large beds of *Equisetum limosum* and *Eleocharis palustris*, with their usual associates, extend along its margin. The beautiful water-lily is a feature of this, as of many other lochs in the district, whilst a botanical item of interest is the occurrence of the water hemlock (*Cicuta virosa*, L.).

The course of the Allander Water, and of its tributary, the Craigton Burn, have been often followed by various sections, and have proved fruitful of results. No separate faunal or floral lists, however, for these localities are available. The formation of the present golf course on Clober Moor, across which runs an old right-of-way, has to some extent altered the features of the ground. Many interesting marsh and moorland plants were formerly abundant here, and most are still to be found in places, especially near the banks of the stream; but drainage has taken place over parts of the moor, and the distribution of these species has in consequence become more restricted.

Craigton Wood, first visited by the Society on 12th October, 1889, for the purpose of collecting fungi, has since then been the scene of other four fungus forays—on 17th September, 1898, 30th September, 1899, 13th October, 1900, and 11th October, 1902. The wood is principally beech, and its dense shade and great development of leaf-mould render it specially rich in the larger fungi. Mains Wood, between Craigton and Bearsden, has also received attention from the botanical and entomological sections. It is more of the nature of a mixed wood, coniferous trees of various species occurring amongst the deciduous ones. The general aspect of the plant-carpet is more varied, and the

shrubby more copious than in Craigton, but the fungus flora is not so rich.

Another wood in this district which has been searched for fungi is Dougalston Wood, on the north side of the road leading from Milngavie to Baldernock, which was visited on 24th September, 1904. Garscube Estate, near Maryhill, was visited with a like object on 18th October, 1902.

III.—THE KILPATRICK HILLS.

The picturesque hill-masses, which compose the northern boundary of the Clyde Valley from New Kilpatrick to Dumbarton, possess many features of interest to students of natural history. The higher parts consist of terraced trap rocks of Carboniferous age, the terraces being very marked and striking in some parts, whilst underlying these are the limestones and shales of the lower carboniferous series, these strata being exposed in some of the glens cut by the numerous streams which descend from these hills. Excursions have been made in various directions from time to time, and the members of the Society have thus been made familiar with most of the places of special interest. The portions of the Kilpatrick range lying north of the Auldmurroch Burn, and east of Gallangad Glen, including Auchineden Hill with its famous "Whangie," the Stockie Moor and Finnich Glen, are included in the county of Stirling, and have already received notice in the paper dealing with excursions in that county. The central portion of the hills and the glens draining towards the Clyde will be dealt with here.

The Society has, on two occasions—11th June, 1892, and 11th May, 1895—made the ascent of Duncomb, the highest point of these hills, 1313 feet, starting on both occasions from Dalmuir, and ascending *via* Duntocher and Faifley, thence by the bed of the Loch Humphrey Burn to Loch Humphrey itself. Near the southern boundary of the Cochno policies, a little to the east, the curious "cup and ring" marked stones in a field adjoining Edinbarnet, proved objects of great interest to the members. These examples at Cochno are very perfect ones, but on the second occasion referred to they were observed to be showing signs of weathering badly.

A fine waterfall on the Loch Humphrey Burn attracted attention, and amongst the plants observed here were the globe

flower (*Trollius Europæus*, L.) and wood cranesbill (*Geranium sylvaticum*, L.), both characteristic plants of the sides of mountain streams. On the higher parts of the hills the crowberry (*Empetrum nigrum*, L.) and the cowberry (*Vaccinium Vitis-Idæa*, L.) were found; and on the rocks, at an elevation of about one thousand feet, the beautiful lady's cushion (*Saxifraga hypnoides*, L.) is very abundant. The parsley fern (*Cryptogramme crispa*, Br.) occurs on the tall slopes of Duncomb. A considerable number of birds (thirty-seven species in all) was reported as having been observed by the ornithologists present. These included the kestrel, sparrow hawk, tree pipit, spotted fly-catcher, golden plover, redshank, and redstart. A small breeding colony of the black-headed gull occurs on an island in Loch Humphrey. On the occasion of the first excursion the abundance of the small heath butterfly (*Cænonympha pamphilus*) was remarked upon.

From the summit of Duncomb a magnificent view to the northward is obtained, and, as on both occasions the Society was fortunate as regards weather conditions, the members of the party were amply rewarded for their climb by a glorious panorama, including Loch Lomond with its islands and the grand background of the Highland mountains. From here, on the first occasion, the party proceeded eastwards, crossing the Auldmurroch Burn, and returning *via* Milngavie. On the second occasion the return journey was made from Loch Humphrey southwards to Old Kilpatrick by a road which passes round the shoulder of the hill overlooking the Clyde above Bowling, from which a grand view was obtained. A great abundance of vernal whitlow-grass (*Draba verna*, L.) was noted along this road.

Besides the two excursions mentioned, the same localities have been visited, once by the ornithological section on 6th May, 1893, and once by the botanical section on 6th May, 1905.

Of the numerous glens of the Kilpatrick Hills, the one which has received the largest share of attention from various sections of the Society is Murroch Glen. Although numerous sectional excursions have been made, however, the Society has only once had a general excursion to this interesting locality, namely, on 10th September, 1892. On this occasion the party walked from Dumbarton station to Murroch Farm, near the

entrance to Strathleven, from which point the glen was followed up for about a mile. In the pond near Dumbarton Station, now part of the recreation ground, the nodding bur-marigold (*Bidens cernua*, L.) was observed. This pond has since been cleaned out, and the species has, in consequence, become extinct in this locality. Near the entrance to the glen specimens of the great horsetail (*Equisetum Telmateia*, Ehr.) were found growing. Murroch Glen is of great interest geologically, owing to the great height of the exposed sections of the strata through which the stream has cut its way. The rocks belong to the "cement stone" series of the upper division of the calciferous sandstones, and these here overlie the lower carboniferous sandstones, and are overlain by the carboniferous traps and lower carboniferous limestone. The exposed strata are composed of regularly alternating beds of limestone and marly shale, the continuity being broken at intervals by trap dykes. The sedimentary rocks were observed to be "charred" at some points by contact with the intrusive dolerite, this being specially noticeable where a vein of gypsum was affected. At a point a little over a mile above Murroch Farm the main stream is joined by a tributary coming from the eastward, the bed of which is cut across, near its junction with the Murroch Burn, by a trap dyke of considerable thickness, through which the water has cut a rather curious opening known as the "Gate of Sodom." A small waterfall at one time existed here, but the basin has been filled by the detritus brought down by the stream up to the level of the dyke, the fall being consequently obliterated. The ring ousel (*Turdus torquatus*) was seen in considerable numbers in the upper part of the glen. The chief plant of interest noted on this excursion was the wood vetch (*Vicia sylvatica*, L.), a rare species in Clydesdale, which occurs in the glen. Other plants noted were the common agrimony (*Agri-monia Eupatoria*, L.) and the grass of Parnassus (*Parnassia palustris*, L.). A few members of the party made the return journey by way of Overtoun to the Dumbarton road, which was thence followed to Bowling.

Overtoun was again visited by the Society on 28th March, 1896, in conjunction with the Natural History Society of Glasgow, when the many fine exotic shrubs in the gardens attracted particular attention. After leaving the policies, the party on this occasion

visited the Caledonian hill-fort on Dunbuie, under the leadership of the late Mr. W. A. Donnelly, who gave many interesting particulars regarding the various finds made during the excavations here.

Auchentorlie Glen was visited on 16th October, 1886, and again on 16th June, 1888. On the latter occasion the Rev. A. S. Wilson, M.A., B.Sc., first President of the Society, acted as conductor, and the party were joined by a few of the students attending the summer Botany class in the Andersonian College, where Mr. Wilson was at that time lecturer. At this excursion the following list of plants, found in the glen, was compiled :—

Sisymbrium Thaliana, Hook.	Asplenium Adiantum-nigrum, L.
Myosotis versicolor, Reich.	Asplenium Trichomanes, L.
Ornithopus perpusillus, L.	Aspidium aculeatum, Sev.
Ruscus aculeatus, L.	Polypodium Phegopteris, L.
Campanula latifolia, L.	Polypodium Dryopteris, L.
Milium effusum, L.	

A service-tree (*Pyrus pinnatifida*) on the side of the carriage drive was measured, girth 5 ft. 2 ins., and an ash near the mansion house girthed 11 ft. 5 ins.

Gallangad Glen has been visited on three occasions by the botanical section, the first excursion being on 7th July, 1900, on which occasion the rare *Pyrola secunda*, L., was discovered here, this being its first record for the county. On the second occasion—22nd June, 1901—the entomological and microscopical sections joined with the botanists, and the glen was fully explored from Caldaron upwards to the waterfall, which is one of the largest and finest in the district. The third visit was on 18th June, 1904. No detailed record of these excursions is, however, available.

IV.—KILMARONOCK PARISH.

The district included in the parish of Kilmaronock, lying between the Kilpatrick hills and the south-eastern shore of Loch Lomond has been twice visited by the Society, the first occasion being on 4th August, 1900, when an excursion to Ross Priory was arranged conjointly with the Natural History Society of Glasgow. After visiting the family burial-ground, the party were met at the

door of the mansion-house by the proprietor, the late Sir George H. Leith-Buchanan, who acted as conductor over the remainder of the estate. A number of fine trees were noted, and measurements taken. A record of these measurements appears in the Transactions of the Natural History Society of Glasgow, vol. VI., page 164. The party returned to Balloch *via* Mount Misery, from which a charming view of Loch Lomond was obtained.

The second excursion in this district, which had for its objective point Caldarvon Loch, took place on 14th June, 1902. The loch is on the estate of Caldarvon, about three miles from Balloch station. Through the kindness of the proprietor, D. S. Mackenzie, Esq., a couple of boats were placed at the disposal of the party, who were thus enabled to visit the islands, on one of which two nests of the tufted duck, one containing six, and the other eight eggs, were seen. On the southern shore of the loch a coot's nest with six eggs was observed, and another with two young birds also attracted attention. Amongst the more noticeable plants found growing on the margin of the loch, the tufted loosestrife (*Lysimachia thyrsiflora*, Ait) and the bogbean (*Menyanthes trifoliata*, L.) are worthy of special mention. A species of bladderwort (*Utricularia*) was also found in the loch near its western extremity, while specimens of *Nitella flexilis*, Ag., were obtained in the deeper water. The white and yellow waterlilies (*Nymphaea alba*, L. and *Nuphar luteum*, Sm.) grow in great abundance in the loch, and a large part of the surface is covered by their floating leaves. Along the roadsides in the vicinity of Caldarvon a number of interesting plants occur, such as the twayblade (*Listera ovata*, Br.), the butterfly orchis (*Habenaria chlorantha*, Bab.), and the lesser wintergreen (*Pyrola minor*, L.).

V.—THE CLYDE, FROM BOWLING TO HELENSBURGH.

An excursion, starting from Dumbarton (where a visit was paid to the Rock) and proceeding up the right bank of the Clyde to Bowling, thence by way of the canal-bank to Old Kilpatrick and Dalmuir, took place on 8th August, 1891. The records are entirely confined to the botany of the district, which is of special interest. The following is a list of the more interesting plants observed on this occasion :—

<i>Clematis Vitalba</i> , L.	<i>Gnaphalium uliginosum</i> , L.
<i>Ranunculus sceleratus</i> , L.	<i>Aster Tripolium</i> , L.
<i>Malva moschata</i> , L.	<i>Lysimachia vulgaris</i> , L.
<i>Malva sylvestris</i> , L.	<i>Glaux maritima</i> , L.
<i>Hypericum perforatum</i> , L.	<i>Solanum Dulcamara</i> , L.
<i>Ononis arvensis</i> , L.	<i>Convolvulus arvensis</i> , L.
<i>Epilobium hirsutum</i> , L.	<i>Veronica Buxbaumii</i> , Ter.
<i>Sedum Telephium</i> , L.	<i>Bartsia Odontites</i> , Huds.
<i>Lythrum Salicaria</i> , L.	<i>Juncus compressus</i> , Jacq.
<i>Angelica sylvestris</i> , L.	<i>Triglochin maritimum</i> , L.
<i>Sherardia arvensis</i> , L.	<i>Scirpus maritimus</i> , L.
<i>Arctium Lappa</i> , L.	<i>Phragmites communis</i> , Trin.

Besides these the following plants were found growing in the quarry at Bowling, viz. :—*Echium vulgare*, L., *Stachys arvensis*, L., *Cichorium Intybus*, L., *Erythræa Centaurium*, Pers., and *Euphorbia Peplus*, L.

Another visit to this interesting part of the Clyde was paid by the microscopical and entomological sections on 3rd June, 1905, but the results have not been specially recorded.

On 21st January, 1899, the Society paid a visit to the Clyde "crannog," opposite Dumbuck, its discoverer, the late Mr. W. A. Donnelly, acting as guide. A strong south-westerly wind prevailing resulted in the flow-tide covering the structure somewhat earlier than had been anticipated, and, as a consequence, the party were unable to make as full an inspection of it as was desired. However, Mr. Donnelly pointed out many of the interesting features of the "crannog," and briefly explained the history of its discovery, and the work of excavation which he had undertaken with the help of some members of the Helensburgh Naturalists' and Antiquarian Society.

Ardmore Point was visited by the Society on 16th September, 1899. Previous to this, two autumn excursions—on 20th October, 1894, and again on 3rd September, 1898—had been made by the ornithological section along the Cardross shore to Ardmore, and their observations led to the expectation that a number of the Arctic waders would be in evidence at this season, the locality being specially favourable for these birds, owing to the large quantity of sand and mud exposed at low tide. However, on the occasion of the Society's visit they were not seen, the only waders observed being the dunlin (*Tringa alpina*), the redshank

(*Totanus calidris*), the curlew (*Numenius arquata*), and the lapwing (*Vanellus vulgaris*). The lateness of the season was not favourable to the botanical members present, but the rest-harrow (*Ononis arvensis*) was observed in bloom on the shore, and specimens of bittersweet (*Solanum dulcamara*), in fine fruit, were gathered. The botanical section paid another visit to this locality in the spring of 1904 (30th April), but nothing of exceptional interest was recorded.

Kilmaheew estate was visited on 7th April, 1900, the policies being entered from the public road at the foot of Bloomhill Glen, and the party then following a path which leads to the old castle. A group of conifers, about forty years old, growing between the burn and the path, attracted attention, the most noteworthy being a fine *Abies Albertiana*, about sixty-five feet high, and beautifully furnished to the ground. Another group at the lower end of the garden also claimed some attention, particularly a specimen of *Sequoia gigantea*, grown in close wood near the avenue. This species is remarkable, when growing in the open, for its very tapered stem, but the particular tree referred to indicates that this feature is greatly minimised when the species is cultivated as a forest tree. After a brief visit to the gardens and plant-houses, the party next visited the mansion-house, beautifully situated at the side of the glen, and commanding a fine view of the Firth of Clyde. In a pond on the opposite side of the glen from the mansion, two mute swans and a number of Canada geese attracted the attention of the photographers of the party.

Darleith Glen was the scene of one of the Society's earliest excursions—on 18th September, 1886; but beyond recording the fact that the excursion took place, no information regarding it has been preserved.

Camis Eskan estate, near Craigendoran, was visited on 20th April, 1895. A number of fine trees were examined here, and the following measurements were taken:—four silver firs by the side of the burn girthed respectively 11 ft. 4 ins., 12 ft. 9 ins., 13 ft. 1 in., and 13 ft. 3 ins.—all sound trees, with long, straight trunks; near the shore road, two beeches measured respectively 11 ft. 8 ins. and 14 ft. 9 ins., but the latter tree had a deeply fissured bole and was evidently past its best; an ash, beyond the saw-mill, girthed 14 ft. 9 ins. at 1 ft. from the ground, and 10 ft.

5 ins. at 5 ft. ; a great maple on the lawn in front and to the east of the mansion-house, girthed 18 ft. 7 ins. at 1 ft., and 13 ft. 8 ins. at 5 ft. ; a wych elm in the centre of the lawn gave 19 ft. 5 ins. at 1½ ft., and 14 ft. 9 in. at 4½ ft. ; and a larch at some distance behind the house, up the burn, girthed 9 ft. 5 in. (These measurements, when not otherwise stated, were taken at the narrowest accessible part of the trunk.) From the tree-tops the call of the chiff-chaff was heard, and a few tree-creepers and a dipper were seen. On leaving the policies, the moor of Killeter was ascended to the summit—Ben-a-Bhuidhe, 1025 ft.—from which a view of Loch Lomond, Glen Fruin, and the Arrochar hills was obtained. This moor, although of very limited extent, is said to be the best grouse-moor in the county, and has yielded as many as sixty-four brace of grouse to two guns in one day's shooting. A few black-game also occur, and in the firwood covers the capercaillie breeds in some numbers.

VI.—ROSNEATH AND GARELOCH.

The shores of the Gareloch and the Rosneath peninsula have received attention from the ornithological and botanical sections at various times, and four excursions of the Society have taken place in this part of the county.

Rosneath was visited on 27th September, 1890, and again on 4th April, 1903. On both occasions the fine trees of the district attracted special attention, particularly the avenue near the church, which is composed of a triple line of trees, the inner being yews, the middle limes, and the outer Spanish chestnuts. The rare fungus *Hormiscium pithyophilum*, Nees., occurs here, parasitic upon the yews. Nearer the Castle there are two well-known silver firs, popularly known as "Adam" and "Eve," said to be the largest of their species in the country. On the first occasion of the Society's visit (1890) these trees were measured, and found to girth 21 feet 8 inches and 21 feet 4 inches, respectively, both at 4½ feet from the ground. The measurements given in the Handbook of the Fauna, Flora, and Geology of the Clyde Area, published on the occasion of the visit of the British Association to Glasgow in 1901, were taken in April, 1895, at the same height, and shew an increase in girth during the four years of 2½ inches and 3½ inches, respectively. These magnificent trees are very

finely developed, the beautiful candelabra-like form of the branching, characteristic of the species, being well shewn. The woods of Rosneath are a favourite observation ground with ornithologists, the chiff-chaff being one of the special birds making an early appearance here in spring.

Garelochhead was visited by the Society on 1st June, 1895, when the party travelled by the line of the West Highland Railway. Beyond Helensburgh the railway crosses the line of the great Highland fault, and the change from the sandstone to the schistose rocks of the Highlands is well seen in the cuttings. Nothing of special note is recorded as having been observed on this excursion, but, as the weather was fine, a visit to the hills above Whistlefield rewarded the members of the party with a magnificent view of the Argyllshire mountains and the entrance to Loch Goil.

On 10th August, 1901, a small party of members again visited Garelochhead, but on this occasion the objective point was the "hut-circles" on the Auchengaich Burn, at the head of Glen Fruin. The evidences of glacial action are very well seen throughout this district, and many stones shewing glacial markings were observed on the way. The hut-circles, which formed the turning point in the afternoon's ramble, are about a thousand feet above sea-level, and are chiefly situated on the left bank of the Auchengaich Burn. There are more than fifty mounds altogether, but only a few have been opened, for it must be borne in mind that, when discovered, every roof had fallen in, and every mound was covered with turf and heather. These ruins evidently mark the site of an old village, but it is a very debatable question as to whether they are to be regarded as dating back to prehistoric times, or are of comparatively recent origin.

VII.—LUSS DISTRICT.

Excursions to Lochlomondside have always been popular with members of the Society, and during the frequent visits to this charming lake, the first objective has in most cases been the picturesque village of Luss. In Volume I. an account was given of the Society's excursions to Loch Lomond, bringing the records up to the date of publication (1893). In the present account the subsequent visits to the south-western side of the lake, and to the

islands included within the county of Dumbarton, will be dealt with.

Luss itself, and the glen behind the village, received a visit on 6th June, 1903, when fine weather favoured the large number of members who attended the excursion. The glen contains much natural birch, holly, and aspen, and the woods afford shelter to a varied and interesting flora, but nothing of special botanical interest was recorded. A nest of the wood-wren (*Phylloscopus sibilatrix*) with eggs was seen; and the occurrence of the king-fisher (*Alcedo ispida*), on the Luss Water, was noted. The following list of Diptera (section Tipulidæ) was compiled by members of the entomological section, as having been noted at this excursion:—

Limnobia nubeculosa, Mg. (common).	L. bicolor, Mg.
L. flavipes, F.	L. nemoralis, Mg.
Dicranomyia chorea, Mg.	Ula pilosa, Schum. (common).
D. pilipennis, Egg.	Amalopsis immaculata, Mg.
Lipsothrix errans, Wlk. (common).	A. unicolor, Schum. (very common at the head of the glen).
Empeda nubila, Schum.	Dolichopeza sylvicola, Curt. (in great numbers).
Goniomyia (sp. ?)	Pachyrrhina annulicornis, Mg.
Molophilus murinus, Mg. (in clouds at two places in the glen).	Tipula longicornis, Schum.
M. propinquus, Egg.	T. varipennis, Mg.
Rhypholophus nodulosus, Meg.	T. hortulana, Mg.
Erioptera tæniotota, Mg.	T. flavolineata, Mg. (one female).
Ephelia marmorata, Mg.	T. vernalis, Mg.
E. submarmorata, Ver.	T. gigantea, Schrk. (common).
Limnophila lineolella, Ver.	

Inchmoan was again visited on 18th June, 1898, when it was observed that the nesting colony of the lesser black-backed gull appeared to be diminishing in numbers, and evidences were apparent that the nests had been much disturbed and many eggs taken. This island used to be frequented by a large number of species of birds, and it is to be regretted that it has not been preserved as a sanctuary during the breeding season. On this occasion, besides several characteristic moorland species, a pair of oyster-catchers were seen, and also several pairs of terns, of which a number of nests with eggs were found. The species was probably the common tern (*Sterna fluviatilis*), but no close view of the birds was obtained. The island is almost entirely a flat, boggy moor, covered with heather and sphagnum, but at the west

point there is a small group of Scots firs, amongst which the golden-crested wren was observed.

On 4th June, 1904, an excursion to Luss took place for the purpose of visiting the islands, on which occasion the party divided, thus being enabled to take in the three islands of Inchmoan, Inchconnachan, and Inchtavannach. On the island of Inchconnachan nests of the redstart and redbreasted merganser were found, and the capercaillie was also observed. The wood-wren and willow-wren were also seen on this island, the latter considerably outnumbering the former. At this excursion a full list of the Diptera observed on all three islands was compiled by members of the entomological section, and is here given as a contribution to the insect-fauna of the Loch Lomond islands.

Dixa (sp.?) Inchmoan.

Limnobia nubeculosa, Mg. Inchconnachan.

Dicranomyia chorea, Mg. Inchconnachan.

Rhypholophus similis, Staeg. Inchconnachan and Inchtavannach.

R. hæmorrhoidalis, Ztt. Inchtavannach.

Empeda nubila, Schum. Inchmoan.

Erioptera trivialis, Mg. Inchmoan.

Idioptera pulchella, Mg. Inchconnachan, Inchtavannach, and Inchmoan.

Limnophila Meigenii, Ver. Inchtavannach and Inchmoan.

L. lineolella, Ver. Inchtavannach.

L. bicolor, Mg. Inchmoan.

L. nemoralis, Mg. Inchconnachan and Inchtavannach.

Anisomera vittata, Mg. Inchmoan.

Analopis immaculata, Mg. Inchconnachan, Inchtavannach, and Inchmoan.

*Pedicia rivos*a, L. Inchconnachan.

Dolichopeza sylvicola, Curt. Inchconnachan and Inchtavannach.

Tipula longicornis, Schum. Inchconnachan.

T. scripta, Mg. Inchtavannach.

T. lateralis, Mg. Inchtavannach and Inchmoan.

Melanostoma mellinum, L. Inchconnachan and Inchtavannach.

M. scalare, Fab. Inchtavannach.

Syrphus tricinctus, Flu. Inchconnachan.

S. bifasciatus, Fab. Inchconnachan.

Inchlonaig, the yew-tree island, received a fresh visit on 30th June, 1900, but as the party were treated during the whole time to a heavy downpour of rain, nothing was observed beyond what

is already recorded as a result of the first excursion to the island in 1888 (see report in Vol. I.).

Inchmurrin, the largest and most southerly of the Loch Lomond islands, was visited on 19th June, 1897. A number of fallow deer (*Cervus dama*, L) occur on the island, but are not in a feral state, being provided with artificial shelters in several places, and also partially hand-fed. A number of well grown oak trees are found in various places, two of which were measured: one about the centre of the island was found to be 15 ft. 4 ins. in girth at 3 ft. north-west, and another at the north end was 18 ft. at 2 ft. east. Two or three families of redstarts were observed, and a nest of the lesser black-backed gull was seen, the latter species having been reported as breeding here for two or three years previously, apparently driven from Inchmoan.

VIII.—ARRÔCHAR DISTRICT.

The earlier visits of the Society to the mountains which surround the head of Loch Long, with the village of Arrochar as a centre and starting point, have already been fully described in the article upon excursions to Lochlomondside in Vol. I. The subsequent visits to points in the Arrochar districts lying within the boundary of Dumbartonshire, have been three in number, namely, 18th July, 1896, 5th August, 1899, and 8th April, 1901.

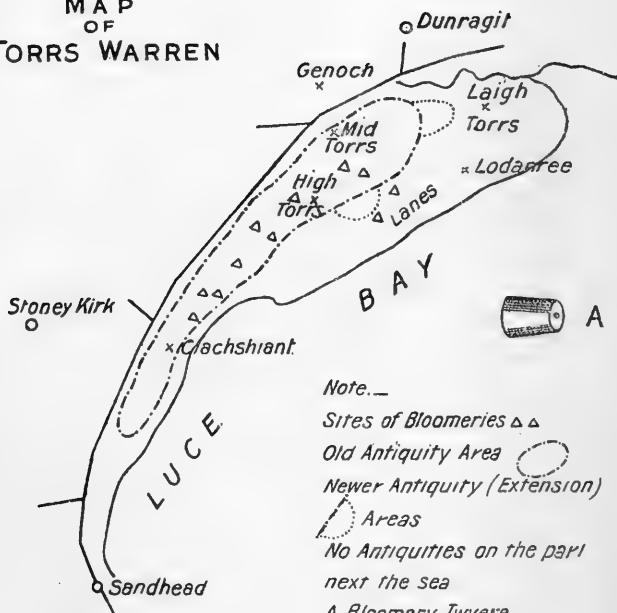
The first of these occasions was during the Glasgow Fair holidays, when a small party of members visited Arrochar and remained over the week-end, the principal objective being, however, in the neighbouring county of Argyll. The weather prevailing being very unsettled, little work was done within the boundaries of the county now being considered, and nothing of interest falls to be recorded. The magnificent ash-tree in front of the Temperance Hotel again commanded the admiration of the party. Particulars regarding the dimensions of this fine tree are given in the former account already referred to.

On the second occasion mentioned the party ascended the hill of Cruach-Tairbeirt, behind Arrochar village. This low eminence, 1364 ft. in altitude, although surrounded by high mountains, nevertheless commands one of the finest views in the district, owing to its peculiarly advantageous position, the summit being in line with the opening of the Loch Sloy valley (the lake itself

being just visible), and also commanding the full length of Loch Lomond. On the occasion of the Society's visit, although the day was fine, a dense white mist obscured the view of the surrounding mountains, but the beauty of the landscape was still sufficiently evident. The yellow mountain saxifrage (*Saxifraga aizoides*, L.) was seen on the banks of the streams in fine bloom, and other plants of interest observed were the rose-root (*Sedum Rhodiola*, L.), the stone bramble (*Rubus saxatilis*, L.), and the lesser club-moss (*Selaginella selaginoides*, Gr.).

On 8th April, 1901—the Glasgow Spring holiday—an excursion to Ardlui (head of Loch Lomond) was arranged with the object of ascending Ben Vorlich. Rain falling heavily throughout the day, the greater number of the party abandoned the idea of making the ascent. Six members, however, attempted the mountain, three of whom succeeded in reaching a small cairn at an altitude of 2,600 ft., at which point the further ascent was abandoned. Snow was encountered at an altitude of about 1,500 ft., all above that limit being covered to a considerable depth, rendering the search for alpine plants impossible. The wind was very high, and the snow was being driven in great clouds, rendering progress difficult. Owing to the heavy rain the streams were all in flood, and the numerous waterfalls in the district were seen to great advantage. The rocks and banks on the lower slopes of the mountain, and especially the wooded glen of the stream above Stuckindroin, were found to yield a rich moss-flora. Particularly striking were the great quantities of the beautiful *Hypnum Crista-castrensis*, L. The filmy fern (*Hymenophyllum Wilsoni*) was found very abundant. Specimens of the rare fungus, *Dædalia quercina*, were found in the woods below Ardlui.

MAP OF TORRS WARREN



Note.—

Sites of Bloomeries ▲▲

Old Antiquity Area (dashed line)

Newer Antiquity (Extension) (dotted line)

Areas (dashed line)

No Antiquities on the part next the sea (solid line)

A. Bloomery Twyre (cylinder symbol)

TORRS WARREN.

By JOHN SMITH.

(Read 29th January, 1903.)

THE Torrs Warren extends from near Sandhead in Wigtonshire to near the Piltanton Burn, a distance of about six miles ; is bounded on the south-east by Luce Bay, and on the north-west, roughly speaking, by the Sandhead road, as far as the Mid Torrs Cottage. It is narrow at both ends and widest towards the middle, where it will be about a mile and a half across. The geological formations of the Torrs are the raised beach and the Æolian deposits, or sand dunes. The raised beach consists of an under division of very well-rolled pebbles, mostly of the grey-wacke rocks of the neighbourhood ; but also of occasional stones of granite, quartzite, porphyrite, etc., a lot of Ailsa rock being present mostly as small rolled pebbles. This gravel has been thrown into low ridges, which are often seen in the hollows of the Torrs, running parallel to one another, and being lost to sight under the sand. This part of the raised beach beds cannot be many feet above sea-level, but is always best exposed the further it is from the sea. Above the gravel lies a deposit of stratified sea sand, which at its thickest part is about thirty feet, and it evidently extended at one time over the whole area of the old antiquarian ground. It is from the deformation by the wind of this part of the old beach that the material of a certain part of the dunes has been derived. Only a few outlying remnants of the sand bed are now to be seen, and any fossils they may have contained have disappeared, as is frequently the case with the fossils of this beach. The Torrs (hillocks) are naturally divided into two sets, those derived from the raised beach sands, and those from the sand blown up from the recent shore. Outside of the Torrs area the older raised beaches of the district are seen at much higher levels, as near Dunragit, and during that period the Irish Sea extended to the foot of the hills, the Rhinns of Galloway having then been an island.

Between the Torrs and Loch Ryan there is a low strath—a geological depression—as old possibly as Permian times (at least a strip of that formation exists along the west side of the loch, and in all likelihood extends under the Torrs, and may continue to a junction with the carboniferous rocks of Cumberland), and from the bits of coal got in the Torrs sands, this is rendered all the more likely. There are sand ridges in the Torrs parallel or nearly so to the present shore line, but some of them a mile from it, and even on the north border of the old sand hills there are remnants of ridges; and one would think that they ought to have been destroyed long ago. I offer the following suggestion as to the reason why ridges of sand may retain their original shape for a long time:—These ridges, I believe, having been originally along a shore line, when the wind blows sand up from the beach it also blows a lot of small shells and shell fragments, with immense quantities of ostracods and foraminifera, along with it, as well as bits of seaweed. This is shortly all bound together by the roots and stems of the marrum; and although the shells may rot away by the percolation of acidulated water, the lime sometimes gets deposited amongst the sand and will, no doubt, remain so, at least for a time. The ridges by and by get covered by a variety of plants, especially by the heaths, heather, brackens, silky willow, various grasses and flowering plants, including myriads of violets. They are now so firmly netted by plant roots that nothing but mechanical means, such as the burrowing of rabbits, or the repeated passage of cattle or carts over certain parts, will allow the wind to get into them, and when it does so it is difficult to stay its progress. Once it gets into a rabbit hole it soon scoops out a hollow, it may be from five to six feet in depth, sometimes in the shape of a nearly circular crater. The vegetation hangs dangling on the edge of the hole and gets so dried up that when it breaks off and slides down the slope it is generally quite dead, and seldom takes root again. These sand holes often increase to a great size, and sometimes get completely covered with vegetation. This is effected in the following way:—In very dry summers the wind scoops out the sand from the bottoms of the holes, and if these dry seasons are followed by wet ones, the sand in the bottoms of the holes becomes permanently damp, and seeds of plants blown into them take root. Once they gain a footing in the bottom of

a hollow they are able to hold their own against the wind, as there is now no undermining going on to dry up and wither them. They now keep creeping up the sides of the hollow till it becomes completely covered by vegetation, at the same time the bottom of it is being gradually filled with sand drifted from its sides, till what was once a hollow, with two or three feet of water in it during the winter months, may become permanently dry all the year round, and if there is no drifting sand near it, it may remain in this state for a considerable period—a paradise for sheep.

Some of the dunes will, I daresay, rise to about a hundred feet above sea-level, and they are quite as high on the more recent parts as they are on any bit of the raised beach area.

The oldest antiquity ground of the Torrs is confined to the raised beach, which may, at its highest part, be forty feet above sea-level, and this is a strong argument in favour of the land having risen several feet since that antiquarian period: the same conditions obtain in Ayrshire.

The newer antiquities may, of course, extend over any part of the old ground, but they are also got outside of it—a little nearer the sea, there being an irregular belt next the sea where no antiquities of any description are found; and this is the same in all the very low patches of beach land in the south-west of Scotland, such as those bits north of Ballantrae and Girvan, as well as that from the Heads of Ayr to Saltcoats, which contain no antiquities nor even chips of flint. The sketch map will give an indication of the respective positions of the different areas.

The old antiquity area occupies large parts of Mid Torrs, High Torrs, and Clachshiant (Clayshant); the newer antiquity (extension) areas occurring as small detached parts on Laigh Torrs and Mid Torrs.

On the higher land, some distance outside of the Torrs, a lot of antiquities have also been got.

To save repetition, the two antiquity areas of the Torrs will be called the old ground, and the new ground.

The old ground presents us with several dark bands, sometimes four, these being evidently old land surfaces, and they have been successively occupied by the people who left the antiques. Some

of these surfaces reach to four feet in thickness. Figures 1 and 2 will give an idea of the irregular manner in which the old surfaces or earth-bands occur, showing that originally they had covered ridges or hillocks of blown sand or deformed raised beach. In Ayrshire the old earth-bands sometimes occur on the nearly level surfaces of the old beaches; but I have not detected any of these in the Torrs, their absence being, doubtless, for the reason that during

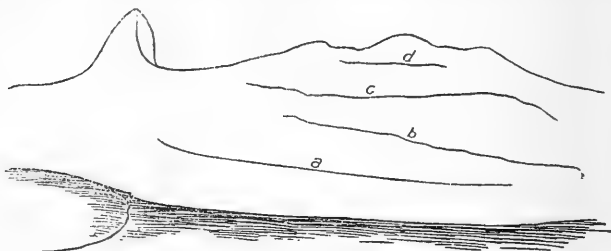


FIGURE I

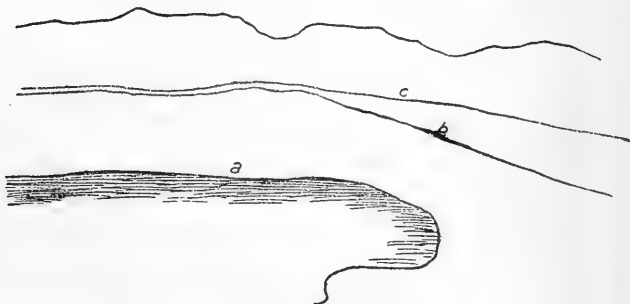


FIGURE II.

the upheaval of the land there was always sand being blown up from the beach.

Figures 1 and 2 show the old soil-bands in which the *older antiquities* occur; a, b, c, d, and a, b, c, are the old soil-bands. Figure 1 section is forty feet high, Figure 2 section, sixty feet high.

The older articles, so far as I know, occur only in or near the surface of the soil-bands, none having been yet got in the beach

beds; and in Ayrshire it is much the same, with one notable exception, a well-made hollow flint scraper, which I found in the forty feet beach bed.—(See "Prehistoric Man in Ayrshire," p. 123.)

No palæolithic articles have been got in the Torrs, and from my point of view it is not likely they will ever be found in Scotland, unless it be in connection with the Mammoth Bed under the drift. On the old ground no mud floors, so far as I can learn, have been detected, but a few remnants of turf walls, and, occasionally, but rarely, small bits of pavement laid with water-worn stones have been blown bare; but it does not seem to have been a practice for the old people to have had their dwellings often floored with anything of a durable nature.

On the new ground, towards the east, there are at present several remnants of mud floors to be seen, but in a short time they will likely get blown away. We do not know, of course, how these floors were laid, but an old man once informed me that he had seen mud floors made in the following way. The tempered clay was rubbed over with a flat bit of wood, often dipped in water, till the floor was smooth and level. It was then left till it was perfectly dry, when its surface was soaked with the blood of a newly-killed pig, and he maintained that by this method a good and durable floor was made.

In many places on the Mid and High Torrs, as well as on Clachshiant, there are great quantities of broken stones, mostly now covering knolls or parts which they have protected from being blown away, and these are often more than a hundred feet in diameter. Broken stones, as well as ancient articles, are also seen sliding down the sides of sand dunes when the sand is being removed by the wind. They come from the old, once occupied, surfaces, which have been long covered by blown sand. The stones may have been broken in different ways, but mostly it is supposed by having been heated to redness and put in water for the purpose of warming it. "Tea" may have been "masked" in this way, and was probably made from agrimony, rue, wood-avens, yarrow, mint, etc., the use of which is not yet entirely given up. It is not uncommon to see many of the heating stones with bits burst or started from their sides which no blow could have detached. The immense number of the stones on the Torrs is a sort of index pointing to a lengthened occupation of the area

by man, the stones having all been placed there by him. A dry sandy surface, thickly covered with stones, prevents vegetation from growing. This is contrary to what might have been expected. I once removed a lot of stones from a small area of sand, expecting the wind would lay bare something good, but to my astonishment this bit became covered with plants, and has remained so ever since. Stones get almost too hot when the sun shines strongly for one to hold his hand on them, and where they occur plentifully on the sand seedlings get scorched. Broken stones are always accompanied by worked flints and hand-made pottery, and they do not occur, to any extent at least, on the new ground. They occupy the old surfaces, one above another, and separated by greater or lesser thickness of blown sand, and reaching from an inch to several feet in thickness. In these surfaces they are sometimes crowded closely together, but often they occur at intervals. The older these surfaces are the older, of course, the articles found in them; but it by no means follows that the antiques got in any particular surface on soil-layer are contemporaneous. At the present time, for instance, we see the articles from, it may be, several dark layers (old surfaces) all reduced to a common level by the blowing away of the sand. This must have occurred before, and not only that, but as the old people were constantly on the look-out for flint-nodules (from which to make arrow-points, scrapers, etc.), quartzite and other pebbles (for hammers, anvils, polishers, etc.), and any kind of pebbles for heating and roasting stones, they, with the exception of the first settlers, would constantly be finding articles, some of them perhaps pretty old, which would be left along with those lying on the ground then being occupied. From this it will be seen that the study of these old land surfaces and the articles they contain is a very complicated and perplexing one, and he would be a very self-confident individual who should "pronounce" with certainty on the relative age of any articles from the ever-shifting sands of Torrs Warren; the best he can do being to make faithful records of what he finds.

Darwin in his *Voyage* tells us that the South American Indians make fires of bones gathered from the land, and he was surprised at the amount of heat those fires gave out. I have seen numerous accumulations, both on the Torrs, and in Ayrshire, of burnt bones.

They are often ascribed to human cremations, but I have never yet seen a human tooth amongst any of them, so that they are more likely just to have been fires of animal bones and are often mixed with wood-charcoal.

The Torrs are exceedingly rich in worked flints, and there will probably be ten times the number (and this applies to other antiques as well) yet to find compared with what has been already found. The arrow points got here are the triangular, the stemmed and barbed, the hollow-based (sometimes lop-sided), the leaf, and the lozenge; the last two forms being the most common. A few of the arrow-points are very neatly serrated along the edges, and as a rule they are worked along both sides and edges. Arrow-heads—when their points had been broken in hunting or in war—were evidently often re-trimmed, at least short and stumpy ones are got, which seem to bear out this notion. Scrapers are abundant: at one traverse from a small area I got about fifty, and one of the old rabbit trappers informed me that he once found sixty scrapers built into the form of a cone nine inches high. They were mixed with struck-flakes, and a hole must have been made for their reception, as a cone of “flints” could not possibly have stood till it was naturally covered by blown sand, unless, of course, it may have been under the protection of a hut. The most common form of scraper is the *languette de chatte*, often astonishing for its small size, some of this type in Ayrshire being much smaller than a finger-nail. Scrapers are peculiar in having the bulb of percussion on the under side, that is to say, the chipping has taken place on the convex side, and this has given them a much sharper edge than had they been trimmed on the opposite side, although I have seen an odd one done that way. Then come the duck-bill, pointed, spokeshave, and hollow, the last apparently used for making arrow-shafts, bone needles, etc. Very narrow flints are got which were probably used as teeth for hackles, and this suggestion is strengthened by the fact that generally a lot of them are got close together as if they had fallen out of a fixing, or handle of bone or wood. On Mid Torrs I once picked up six lying quite close together, and expected to get more, but a sudden change of wind covered the place with sand. Very delicately sharp-pointed flints are occasionally got, and have probably been used as tatoöers or lancets. Borers, drills (both

right and left-handed), saws (some of them beautifully made), knives, trimmed-flakes, etc., and even the comparatively recent gun flints, are got. The latter are rare in Ayrshire; for instance, they probably do not average above one to five thousand of the old flints. Strike-a-lights, burnt flints, and cores, from which flakes were struck, are also found. The Torrs flint is generally of a grey colour, but occasionally some of it is reddish, yellowish, or pretty dark; and nodules of the flint occur in the raised beach sands and gravels. Small bits of Irish chalk (limestone) are rare—similar bits having been got in Ayrshire. Pitchstone of a dark colour is rarely got in a “worked” state; this substance is also got in the antiquarian area of the drifting sands in Ayrshire, but no pitchstone is known to occur in the rocks of the south-west of Scotland; of course it is plentiful in Arran, but for my part I have never found *in situ* the particular quality that is got on the antiquarian ground of Wigton and Ayrshire sands. Also, the so-called flaker, evidently a flint tool much used in shaping the flint articles, is got occasionally. In the south-west of Scotland I do not know of any undoubted instances of polished flints having been found. Two specimens are known, but from their appearance it makes it difficult for one to accept them as “native.” Rubbed bits of hæmatite occur, and it was probably used as a pigment. Flint in the Torrs is much more abundant than in Ayrshire, and in the old *fleerish-days* the Torrs was a “quarry” supplying a large part of the south-west of Scotland with strike-a-light flint, and from my point of view this is to be accounted for by the former locality being much nearer the source of supply—the Antrim flint-bearing chalk—than the latter. It has been suggested that the flint may have been brought from the Irish coast by floating ice, or even by man, but these theories do not work out, as large bits would have been brought by these means as well as small bits. All the flint nodules and the made “flints” are small, and as I suggested in 1879 (see *Trans. Geol. Soc., Glasgow*, Vol. VI., p. 185), the nodules are more likely to have been brought attached to seaweeds.

There is another substance, probably also from Antrim, that is, pumice, which is got both at the Torrs and in Ayrshire. (See *Trans. Geol. Soc., Glasgow*, Vol. X., p. 340.) Portlock, in his *History of Londonderry*, says that pumice occurs *in situ* in the

cliffs near the Giant's Causeway. So far as I know, only one article made from this Irish pumice has been got. I found it on old ground on the Mid Torrs, and it looks as if it had been used for playing at some kind of game.

Articles other than those made of flint, or the various stones used as hammers, are rather scarce, and mostly confined to stone whorls and beads. I only know of one stone brace having been got—on Mid Torrs.

I know of no substance having been obtained used for *fixing* implements, etc., into handles or shafts, but in Ayrshire I once picked up a bit of material which may have been a remnant of some kind of fixing stuff. It looked so, having been prepared from some kind of resin or gum. The only kind of native resin we have is from pine trees, then probably only represented by the Scots pine; and gum exudes plentifully from the gean.

Some very fine beads have been got on the Torrs, but they are rather rare. A few are of amber, and it may have been brought from the east coast. At least, I know of no native amber as occurring in the south-west of Scotland. Yellow, three-lobed glass beads, with blue bands; triangular plain glass, with yellow bands; plain blue, green, and pink glass; yellow, vitreous paste; and green paste (some of them star- or beaded shaped) occur; and a few have been made of volcanic ash.

On a spot on Clachshiant very old window glass is to be got; weathering having brought out a peculiar structure which shows like successive bands of lamination—a sort of rhyolitic structure, probably given to it during its casting by having been run on to a flat plate. It has also got the rainbow colours commonly seen on old glass. I have found a somewhat similar glass in the refuse heap of an old Ayrshire castle. Neither of these glasses have been cut by a diamond, but are neatly chipped along the edge.

The so-called “jet” of the Scottish antiquarian is probably in no case real jet, but cannel, parrot, or gas coal, sometimes oil shale, from the carboniferous formation. The articles which have been most commonly made from these substances are bracelets, rings, beads, pendants, and discs, sometimes with a little ornamentation. The discs are both plain and perforated; the latter form being sometimes exceedingly rough objects, for

which it is difficult to conceive a use. (See *Trans. Geol. Soc., Glasgow*, Vol. VI., p. 185.)

Hammer stones are frequently got, the favourite material having been well-shaped oval pebbles of quartzite, as combining in itself the useful properties of great hardness and toughness; but quartz, granite, Ailsa rock, greywacke in its varieties, greenstone, etc., have been used. Some of these hammers have been trimmed till a sharp ridge, generally at the end or ends of a pebble, has been formed, and as this ridge (which sometimes passes obliquely over the end or even right across) seldom has a chip broken from it, it shows that the ridge must have been of prime importance for certain kinds of work, and also how carefully the hammers had been used. Other hammers had been sorely battered at the ends, and some on all the sides. The finger and thumb hammers have a neatly-made hole on each side, generally of a flat, sometimes roundish, pebble. In fact, pebbles of any shape, from the oval-flat-compressed to the nearly globular, have been made use of as hammers. It is quite common to see stones very suitable for using as hammers, and yet they show no marks of usage: they were probably kept in stock, and are frequently got where flint chips and iron slag abound.

Sling stones are scarce, but suitable pebbles would, of course, be oftenest used as sling stones; but I refer to stones—often flint—which had been trimmed.

A few perforated hammer axes have been found.

All kinds of stones have been used as anvils, which are easily recognised by their battered surfaces, and were probably always used when flakes of flint were being struck off.

Urns of different shapes, and ornamented in a variety of patterns, have been obtained from the Torrs, and probably belong for the most part to the "Bronze Age," bronze articles having been found in some of them. I was informed by one of the trappers that he had seen an urn with the bones in it reduced to particles about the size of barley, and he suggested that they were the remains of the cremated bones of a child. Those who are in the habit of searching for "antiques" soon learn to know the spots where urns may be lying. When the wind blows an old surface bare this surface is always of a dark colour, but if there is a gray patch on it an urn will probably be found in such a spot.

This shows that a hole had been dug, in which the urn had been placed ; but urns appear also to have been laid on the surface of the ground, and a mound raised over them. There are also places where urns have been kept in stock, but there are no guiding marks to these spots. I dug for several days at a place on the High Torrs, five hundred yards north-west of the steading, where there were many fragments of urns. They had belonged to several types, all hand-made and ornamented, and as there were no burnt bones in connection with them, the place had probably been used as a store, and the fragments had likely belonged to "wasters," accidentally broken or badly fired, as the "paste" of some was quite soft, and crumbled easily between the fingers. I found little else here but urn fragments. A hammer stone turned up which had been much worked with, but only at one end. I have seen many fragments of hand-made pottery which had probably been buried full of food, as, crusting the inside surfaces, there is a thin layer of a carbonized substance. They may, of course, have been used for preparing food or "masking tea," and had never been cleaned. On the Ayrshire sands I have also found places where urns had apparently been kept in store. Favourite places for the burial of urns have been the summits and sides of sand ridges and dunes. Stamps, probably made of a perishable material, as wood or bone, appear to have been used in ornamenting urns. I dug up a large part of one which had been ornamented by a stamp, and the ornamentation carried from the top of the rim all over the sides and bottom. There is a popular belief that these old hand-made urns, etc., were finished by being simply sun-dried. There never was a greater mistake. They have been all certainly burned, and their elegant shapes, when we consider that they had been hand-made, show that urn-making was a trade carried on by skilled workmen. The tempering of the clay for them had been also particularly well attended to, and I have found fragments which show that it had sometimes been mixed with grass or broken bits of quartz, etc.

Mediæval pottery, both glazed and unglazed, is not infrequently got, and extends on to the new ground ; it has all been made on the wheel. Stone axes are by no means frequently found on the Torrs. I dug at the west end of the beach, about eight hundred yards west north-west of High Torrs steading, where much broken

flint is lying on bare sand. Here I got some bits of a polished axe of fine grained felstone. Perhaps the majority of British "celts" have been made of this substance, and yet no rock has been found in the British Isles which could have supplied the material. This dark layer had certainly never been laid bare to the weather since the axe-fragments were first covered up, as the fine polishing and minute scratches were still quite apparent on its surface, and the edge remarkably sharp. Along with it were a flint skinning knife, a hollow scraper, some ordinary scrapers, plain hand-made pottery fragments, and abundance of broken stones and flint chips. I worked for several days at this of-old inhabited surface, which had at one time been covered deep in blown sand, and found no other kind of articles than those mentioned, but the searcher may dig for a long time at certain favourable-looking spots without getting any antiquarian reward at all, and fails by not continuing his efforts long enough, for the antiques are sometimes thinly scattered. The wind, of course, is the great searcher-out of these old articles, and it is only he who has the time and opportunity to follow where it lays bare that can expect to reap the harvest of the wind.

Rubbers, whetstones, and polishers are frequent, the polishers, in fact, abundant, and burnishers are occasionally got. I know of no polished flint article having ever been found on the Torrs (or in Ayrshire), with the exception of the doubtful natives already mentioned, so that articles of this description got here have probably been used for rubbing and polishing stone, beads and whorls, "celts" or hammer-axes, etc., or for bronze or iron articles. It is not uncommon to find stones which had been utilized as combined hammers and polishers.

Needle-sharpeners, or at least stones used for giving a finished sharp point to articles, are not uncommon; and grooved stones, which had evidently been used in forming the outside curves of coal bracelets and rings, rarely occur.

Pins of bronze, with riveted-on and twisted-wire heads, are not unfrequent, and perhaps commonest at the Laigh Torrs huts. I have picked up a score of them mostly on the new ground. They are also frequent at the "Roman Camp" on new ground; it appears to mark the boundary of the antiquarian area in that direction. Bronze articles are frequently got; and I have a very

beautifully ornamented bracelet of copper from High Torrs. The trappers inform me that the part most prolific in "bronze" is that on either side of the march fence between Clachshiant and High Torrs. Rings have been got; one said to be inscribed with runes has gone out of the country, but it is to be hoped it will find its way back; penanular rings or brooches, low-shaped fibulæ, fish hooks, buckles, buttons (I have one from new ground with the name of a London firm on it), pendants, keys, needles, mountings, paper fasteners, etc.

Melting pots, probably mostly used for bronze and lead, are rarely got. I have seen in Ayrshire particles of gold sticking to a fragment of a crucible. Archæologically the word "bronze" is used as a sort of generic term: many of the articles may be of brass, copper, or "mixed metal." Iron articles are sometimes found coated with "bronze"; and bronze articles inlaid with "nielo" and silver have been found.

Scraps of lead are frequent, especially on the new ground, and occasionally whorls, bullets, etc., of it are got.

On a flat part of the Torrs, not far from Horse Hill, there was blown bare some fourteen years ago, a part where a burial mound had been raised over an interment. I saw it at the time when it was still fresh and the place dry and level, but it is now occupied by a water hole. This mound had been covered to a certain extent by water-worn stones, and when it was blown away the stones were left as a ring on the sand. This ring was ten paces in diameter and six feet broad, but has since been much destroyed by people searching for articles in it; a large proportion of the stones were white quartz. In the centre of it, when I saw it first, there was a lot of calcined bones, and the trapper took two urns from it which are now in the museum at Edinburgh. The urns, strange to say, were not got in the centre of the ring, but in the part now covered by the stones, so that this interment had probably taken place in a ring mound.

Five hundred yards south of Mid Torrs standing there is a lot of light coloured stones which probably had been connected with an interment; many broken stones are lying round about them.

In an urn from Mid Torrs there was got a bronze dagger, a polisher, and four white quartz pebbles. I have seen an Ayrshire

urn emptied of its calcined bones, but no articles of any description were got in it, so that it does not seem to have been a constant practice to place some favourite article in an urn. Some fourteen urns were recently found (1906) in a cairn on the Ardeer sands, Ayrshire; a number of them contained white quartz pebbles, but only one held articles of human make—three beads and bits of gold leaf.

I unearthed on the Laigh Torrs, not far from the huts, a very fine under quern stone, the "sitter" of grey granite, which would weigh about two cwts. Its grinding surface slopes gently from the centre towards the circumference, there being a boss in the middle with a shallow-spindle socket penetrating it. At the huts I found a fragment of an upper quern stone which appeared to fit the one described; and a few other quern stones have been got on the Torrs. But saddle-querns or grain-rubbers rarely turn up. At High Torrs steading there is a large and very fine granite clachnotin, or barley-mill.

I have counted eleven places, "Bloomeries", where iron has been manufactured on the Torrs, easily known from the heavy black slag lying about; and the remains of hearths, with bits of their fire-clay lining.

Some of those now on low and flooded ground may originally have been higher; but others are still at their original level, with the burnt fire-clay still resting on a layer of soft clay, showing that they had not been lowered by the blowing away of the sand.

Iron is not unfrequent, but the articles which have been made from it are generally in a very unsatisfactory state of preservation, all that one gets being often a mass of sand-crusted rust. Still, there is sometimes enough of the original shapes left to show that the old iron-workers of the Torrs were not devoid of artistic taste, and as no iron hammer-heads have been got on the Torrs (nor in Ayrshire), they probably used the hammer-stones as hammers for their iron work. The late Mr. Edward Carrick, of Dalry, in Ayrshire, Inspector of Mines in Rhodesia, South Africa, sent home some articles in iron which he had seen the natives fashion with stone hammers, and they are really very good bits of workmanship. Even some of the iron objects got on the Torrs had been coated with bronze. Recognisable iron articles comprise—arrow or fish-spear heads, knife-blades, rings, spring clip-shears, keys, etc. On

the *new ground* I have collected what may have been the rivets of a shield. Of course, we must always remain in the dark, or nearly so, as to the articles which may have been imported, but when we know that these old people had at least eleven "iron-works" (and very likely several times that number), it is most likely that all the iron articles recovered are native to the place; and at the period when these works were in "full swing" it may have been the "black country" of the south of Scotland.

A few tobacco pipes, elf pipes of the old small-headed type, with the boll removed at but a small angle from the line of the stem, have been got mostly on the new ground; any of them I have seen are dirty grey in colour. No stone pipes—such as those got in America—have, so far as I know, been found on the Torrs or in Scotland. Before the introduction of tobacco, sphagnum was the "weed" used for smoking, and "dishalage" (*Tussilago Farfara*) is still smoked by people who have got a "sitten-doon caul."

I think I am within the mark when I say that at least three hundred coins have been got on the Torrs, but, so far as I can learn, none of them are *Roman*, the oldest being *Anglo-Saxon Styca*, and probably of the eighth or ninth century. A spot prolific in coins occurs on Clachshiant, and another on Laigh Torrs on the new ground at the huts. The last-named site, where some mud floors have been laid bare and are at present to be seen, has furnished a great variety of articles, especially fragments of pottery, some of very elegant designs and even hand-painted; complete glass bottles of large size are said at one time to have been common, and "bronze" and iron articles abundant; sleeve links have been got, and I have one showing a minute and beautiful design in enamelled work. The pottery got here, although having a somewhat recent look and so apt to be passed over by the young archæologist, is very much rarer than the old hand-made pottery and urns of the old ground; in Ayrshire, after thirty-one years' search, I have seen not more than half-a-dozen fragments belonging to this particular type, which consists of a considerable number of varieties. From its somewhat recent look it seems to be "tabooed" from museums. The articles got at the huts are likely to be several hundred years old (probably none of them are less than two hundred years old), and in the district there is no tradition as to houses ever having been here. The people

who inhabited this site had probably been obliged to quit it in a hurry, leaving everything behind them, and never returned; perhaps it was suddenly overwhelmed with sand.

There are but few names of localities on the Torrs. On the old antiquity ground we have High and Mid Torrs; Knock Slide, five hundred yards south-east of Mid Torrs standing, a good locality; Clachshiant, and the site of a traditional church, said to be the original Clachshiant (the saint's grave); it looks like part of an old earthwork fort. There are also the remnants of the turf walls of what is thought to have been another church (near the Genoch) on Mid Torrs; Horse Hill, already mentioned, must be nearer the boundary of the old antiquity ground on its east side. Knock Slide must have been a hillock when first named, but it is at present a "howling waste" of drifting sand. On the new antiquity ground there is the "Roman Camp," most likely quite a recent fanciful name, as no Roman antiquities have been got on the Torrs. The Laigh Torrs Huts is evidently quite a recent name. Outside of the antiquity ground and nearer the sea, we have Lodanree (the grave of the king), half a mile south of Laigh Torrs standing; Lodanmore, west of Lodanree; Wee Lodanmore, five hundred yards west-south-west of Lodanmore; Knock Allan, between Lodanmore and Wee Lodanmore; Fleckit Hill, five hundred yards west of Lodanmore; and the Minix, now a water hole surrounded by steep banks, one mile west of Laigh Torrs standing. The Lanes is a low grassy part of the Torrs, with slight ridges parallel to the coast line, and during winter a large part of it is covered by water. It extends for a long distance, and separates the sand dunes of the shore from those of the raised beach at the part where it occurs. The Lane Pad is a footpath over the sands known only to those in the neighbourhood, and extends from Mid Torrs to the Lanes. It will be seen from this that the Torrs' names are mostly of Gaelic origin.

I know of no undoubted remains of old forts having been discovered on the Torrs; the so-called "church" on Clachshiant is the only remnant of what may have been a fort.

Shell mounds appear to be entirely absent, and this is strange considering how rich the beach is now in solons and cockles; pretty large oyster shells are often brought ashore by the waves, and *Cypria* is sometimes seen, a good edible species and common

in the shell mounds of the north of Ireland, which are being accumulated even at the present time. An occasional much-decayed bone may be laid bare, but I know of no accumulations of bones, nor of any articles having been got made of bone, horn, wood, or leather. Gold articles appear to be absent as well as silver ones, with the exception of coins and some "inlaying" in that metal.

At page 88 of the *Catalogue of the National Museum of Antiquities of Scotland* occurs the following:—"The close correspondence in general character of the two collections, from Glenluce Sands [Torrs Warren] in the south-west and from the Culbin Sands in the north-east of Scotland, is very remarkable, but the differences in detail are even more striking." Doubtless the "differences" might be less so, had everything got at these two famous localities found its way into the museum, and it is to be hoped they yet may.

The Torrs Warren compares almost item for item with Ayrshire in the matter of hammer stones, polishers, worked flints, and stone whorls; gas coal articles are commoner in Ayrshire. There are, perhaps, as many "urn" fragments in Ayrshire as in the Torrs, but they seldom show any ornamentation; green-glazed wheel-made pottery is equally common at both places. The *new ground* pottery, which might be called the Huts Pottery, is all but absent in Ayrshire; but in other antiques the Ayrshire sands are comparatively barren compared with those of the Torrs, the number of bits of coins, for instance, got in Ayrshire may be counted on the fingers, the oldest one I have found on the sands of the latter place being an Arabic coin of the ninth century.

The sands of the Torrs are said to be moving at a greater rate at the present time than they were formerly, and certainly one sees a large area of vegetation being covered by blown sand. This is ascribed to the loosenings made by rabbits, the wind getting entrance at these places—the Torrs for a long time having been used as a rabbit warren.

The marram (*Psamma arenaria*) seems to be the sole occasion of the sand accumulating into high ridges and torrs, and it keeps on growing where the sand is drifting most plentifully. The sand sedge (*Carex arenaria*) is a great binder, its underground stems extending for several yards, but it does not assist in making hillocks, as its habitat is in the damp hollows.

Truly the *Torrs Warren* is a wonderful place, with its abundant archæological remains of peoples of past ages; but not a single inscribed stone has been "unearthed" to tell us the name or qualifications of any one of them.

NOTE.—Since the above paper was read to the Society I have made a great many traverses in the Torrs, and done some digging. The results of the latter have been to make out what I think are some new points in Scottish archæology in connection with the iron bloomeries. The first was the finding of the twyeres through which the blast (air) had been supplied to the furnaces. These twyeres are shaped just like those of a modern blast-furnace twyere, the only difference being that they are made of fireclay instead of iron. In size they are about four inches long and three inches wide, the hole for the passage of the blast being about half an inch in diameter, and this passage often shows wearing from the scourer of the blast. The second was the finding of the iron bars which had been used in the working of the little furnaces. The actual bars are so rusted that nothing can be made of them; but I got bits of the slag which still retain the exact "print" of the bars, showing that they had been square and seven-sixteenths of an inch in thickness. The results of these diggings also showed that there had been at least two types of bloomeries—one where the metal had been smelted in fireclay crucibles, and the other where it had been allowed to accumulate in the "hearths" till a sufficient quantity was made. Perhaps where the crucibles were used the process may have been a refining one where the iron or steel was smelted over again. The shape of the "cinder-blocks" is also worthy of note, they, for the most part, being pretty much like birds' nests, and from three to eight inches in diameter—sometimes they are solid. I call them "bloomery dottles." In Ayrshire, at Shewalton, I once found an ingot of iron which had evidently been made in the hearth of a bloomery, its shape being that of a solid cinder-block. It is pretty free from slag and only required "shingling," that is, heating and hammering, to make it into good serviceable material.

I once tried a fireclay twyere on a modern blast furnace, but it lasted only a short time.

CLYDESDALE FUNGI.

By R. B. JOHNSTONE.

SINCE the publication of the previous list of Clydesdale Fungi in Volume II. of the Annals in 1900, the Society has regularly made excursions in the autumn to the woods around Glasgow in the search for fungi, and to the disappointment of the mycologist there has been on these visits a noticeable scarcity of even the common species. The seasons have been either very dry, or wet and cold, with an absence of the warm moist weather so essential to the growth of fungi.

Notwithstanding the somewhat meagre records, the interest in the subject has been sustained by the discovery of a few species rarely, if ever, met with before in this district. Among these may be mentioned *Lepiota Friesii*, *Flammula inopoda*, *Lentinus lepidus*, *Trogia crispa*, *Strobilomyces strobilaceus*, *Dædalia quercina*, *Merulius tremellosus*, *Mutinus caninus*, and *Clavaria fistulosa*.

The following is a list of the places visited, and the dates (see Addenda):—

FINLAYSTONE, LANGBANK, 29th September, 1900.

CADZOW FOREST, 6th October, 1900; 3rd October, 1903; 7th October, 1905.

CRAIGTON WOOD, 13th October, 1900; 11th October, 1902.

CADDER WILDERNESS, 20th October, 1900; 19th October, 1901; 21st October, 1905.

CATHKIN BRAES, 27th October, 1900.

LENNOX CASTLE, 28th September, 1901.

POLLOK ESTATE, 5th October, 1901.

DOUGLAS SUPPORT, ROSEHALL, 27th September, 1902.

ERSKINE ESTATE, 4th October, 1902.

GARSCUBE ESTATE, 18th October, 1902.

HAWKHEAD ESTATE, 17th October, 1903.

DOUGALSTON ESTATE, 24th September, 1904.

HAMILTON LOW PARKS, 8th October, 1904.

ROUKEN GLEN, 15th October, 1904.

WEST FERRY WOOD, LANGBANK, 30th September, 1905.

JOHNSTONE CASTLE, JOHNSTONE, 14th October, 1905.

The lists at these excursions were compiled by the writer, with the exception of those of the micro-fungi, which is the work of Mr. D. A. Boyd, of Seamill, West Kilbride, who also kindly rendered assistance in identifying the larger fungi. Thanks are also due to Dr. Plowright, King's Lynn, Norfolk; Rev. D. Paul, LL.D., Edinburgh; Mr. A. D. Cotton, F.L.S., Kew; Mr. Carleton Rea, B.C.L., M.A., Secretary of the British Mycological Society; and Mr. William Stewart, Glasgow, for naming unknown or doubtful species.

The following list comprises species not recorded in Volume II., and brings our records up to date. The capital letter in the last column denotes those not found at these "forays," but which have been either noted at the ordinary excursions, or exhibited at the monthly meetings.

A = Botanic Gardens, Glasgow.	G = Earnock.
B = Ayr.	H = Rosneath.
C = Kilwinning.	J = Fiddler's Gill, Braidwood.
D = Rowardennan.	K = Dalry.
E = West Kilbride.	L = Glasgow.
F = Ardlui.	

The same authorities for the nomenclature has been followed as in the former list for the Hymenomycetes and Gastromycetes, and for the micro-fungi the authorities are Saccardo's *Sylloge Fungorum*, Phillips' *Manual of the British Discomycetes*, Plowright's *Monograph of the British Uredineæ and Ustilagineæ*, and Massee's *British Fungus Flora*, Vols. III., IV.

HYMENOMYCETES.		Cadzow.	Craigton.	Cadder Wilderness.	Lennox Castle.	Douglas Support.	Garscube.	Hawkhead.	Rouken Glen.	Johnstone Castle.	West Ferry.	
Agaricini.												
LEPIOTA.												
AGARICUS FRIESII, Lasch.	...					×						
AG. CRISTATUS, A. & S.	...					×						
TRICHOLOMA.												
AG. RESPLENDENS, Fr.	...									×		
CLITOCYBE.												
AG. NEBULARIS, Batsch.	...					×	×	×				
AG. CERUSSATUS, Fr.						×					
COLLYBIA.												
AG. MACULATUS, A. & S.	...			×								

[illegible]

	Cadzow.	Craigton.	Cadder Wilderness.	Lennox Castle.	Douglas Support.	Garscube.	Hawkhead.	Rouken Glen.	Johnstone Castle.	West Ferry.	
M. LACRYMANS, Fr. ...											L
SOLENIA ANOMALA, Fr. ...	x		x					x			
Hydnei.											
HYDNUM AURISCALPIUM, Linn. ...											E
H. OCHRACEUM, Pers. ...							x				
H. FARINACEUM, Pers. ...							x				
IRPEX CARNEUS, Fr. ...							x				
RADULUM ORBICULARE, Fr. ...					x						
PHLEBIA MERISMOIDES, Fr. ...			x				x				
GRANDINIA GRANULOSA, Fr. ...	x							x			
Thelephorei.											
THELEPHORA ANTHOCEPHALA, Fr.											C
T. LACINIATA, Pers. ...		x	x								
STEREUM SPADICEUM, Fr. ...	x						x	x			
CORTICIUM LÆVE, Pers. ...									x		
C. QUERCINUM, Fr. ...							x				
C. POLYGONIUM, Pers. ...			x								
C. COMEDENS, Fr. ...	x							x	x		
CYPHELLA MUSCICOLA, Fr. ...											J
Clavariei.											
CLAVARIA AMETHYSTINA, Bull. ...					x						
C. CINEREA, Bull. ...	x						x				
C. INÆQUALIS, Fl. Dan. ...	x										
C. VERMICULARIS, Scop. ...							x				
C. JUNCEA, Fr. ...											G
PISTILLARIA QUISQUILARIS, Fr. ...	x						x				
Tremellinei.											
TREMELLA FOLIACEA, Pers. ...							x				
T. TUBERCULARIA, Berk. ...							x				
EXIDIA GLANDULOSA, Fr. ...											H
DACRYMYCES DELIQUESCENTS, Dub.							x	x			
D. STILLATUS, Nees. ...	x						x	x			
GASTROMYCETES.											
Nidularieae.											
CYATHUS VERNICOSUS, D.C. ...											B
CRUCIBULUM VULGARE, Tul. ...							x				
NIDULARIA PISIFORMIS, Tul. ...								x			
SPHEROBOLUS STELLATUS, Tode.	x				x		x	x			
Phalloideae.											
MUTINUS CANINUS, Fr. ...		x					x				

MICRO-FUNGI.

Myxomycetes.

RETICULARIA LYCOPERDON, Bull. On a tree stump. ...		×			
ARCYRIA INCARNATA, Pers. On decaying branches. ...	×				
LYCOGALA MINIATA, Pers. On dead wood. ...			×		
TRICHIA CHRYSOSPERMA, Bull. On dead wood. ...	×		×		×

Phycomycetes.

SPINELLUS FUSIGER, Link. On decaying agarics. ...				×	
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Ustilagineæ.

UROCYSTIS ANEMONES, Pers. On <i>Ranunculus repens</i>				×	
ENTYLOMA MICROSPORUM, Ung. do. ...				×	
PROTOMYCES MACROSPORUS, Ung. On <i>Ægopodium</i> <i>Podagraria</i>		×			×

Uredineæ.

PUCCINIA POARUM, Neil. (As <i>Æcidium</i> .) On <i>Tussilago</i> <i>Farfara</i>		×			
P. MENTHÆ, Pers. On <i>Mentha aquatica</i>					×
P. OBLONGATA, Link. (As <i>Uredo</i> .) On <i>Luzula</i> <i>maxima</i>					×
P. BARYI, B. & Br. (As <i>Uredo</i> .) On <i>Brachypodium</i> <i>sylvaticum</i>					×
P. CHRYSOSPENII, Grev. On <i>Chrysosplenium opposi-</i> <i>tifolium</i>					×
MELAMPSORA BETULINA, Pers. On leaves of birch. ...				×	
M. CIRCÆÆ, Schum. (As <i>Uredo</i> .) On <i>Circa</i> <i>Lutetiana</i>					×
M. VACCINIORUM, Link. (As <i>Uredo</i> .) On <i>Vaccinium</i> <i>Myrtillis</i>					×
COLEOSPORIUM SONCHI, Pers. On <i>Tussilago Farfara</i>				×	
C. CAMPANULÆ, Pers. On <i>Campanula rotundifolia</i>	×				
MILESIA POLYPODII, B. White. On <i>Blechnum boreale</i>					×

Discomycetes.

MORCHELLA CONICA, Pers. On the ground. ...		×			
HELVELLA LACUNOSA, Afz. On a hedge-bank, near Dalry.					
HELOTIUM LUTESCENS, Hedw. On dead branches. ...			×	×	
H. VIRGULTORUM, Vahl. On fallen twigs. ...					×
H. SCUTULA, Pers. On dead herbaceous stems. ...					×
H. PRUINOSUM, Jerd. On dead Pyrenomycetes. ...					×
MOLLISIA ATRATA, Pers. On decaying stem of an umbellifer.					×
M. CINEREA, Batsch. On decaying wood.					×
DASYSCYPHA CALYCINA, Schum. On dead branches of larch.	×	×	×		
D. APALA, B. & Br. On dead culms of rushes. ..					×

	Cadzow.	Cadder Wilderness.	Hawkhead.	Johnstone Castle.	Rouken Glen.
CORYNE URNALIS, Nyl. On deaying wood. ...	x			x	x
SARCOIDES, Jacq. On decaying wood. ...		x		x	x
ORBILIA LEUCOSTIGMA, Fr. On rotten wood. ...					x
VINOSA, A. & S. On decaying branches. ...					x
RHYTISMA ACERINUM, Pers. (As <i>Melasmia acerina</i> , Lév.) On leaves of <i>Acer pseudo-platanus</i>				x	
TROCHILA LAURO-CERASI, Desm. On dead leaves of <i>Prunus lauro-cerasus</i>					x
Perisporiaceæ.					
PODOSPHERA OXYACANTHAE, D.C. Mycelium on leaves and twigs of <i>Cratægus</i>					x
Pyrenomycetes.					
CORDYCEPS MILITARIS, L. On dead pupæ of Lepidoptera.		x	x	x	
USTULINA VULGARIS, Tul. On a decaying stump. ...				x	
HYPOXYLON COCCINEUM, Bull. On dead wood. ...	x		x		
ANTHOSTOMA TURGIDUM, Fr. On dead bark of beech.	x				
DIATRYPE DISCIFORMIS, Hoffm. do.	x			x	
Sphærospideæ.					
VERMICULARIA TRICHELLA, Fr. On dead leaf of <i>Hedera</i> .					x
DARLUCA FILUM, Biv. Parasite on <i>Trichobasis oblongata</i> .					x
SEPTORIA STACHYDIS, Rob. & Desm. On <i>Stachys sylvatica</i> .					x
S. URTICÆ, Rob. & Desm. On leaves of <i>Urtica dioica</i> .				x	
Melanconieæ.					
GLÆOSPORIUM FAGI, Desm. & Rob. On fallen beech leaves.				x	
LIBERTELLA FAGINEA, Desm. On dead bark of beech.	x				
STEGANOSPORIUM PIRIFORME, Hoffm. On dead bark of <i>Acer pseudo-platanus</i>				x	
Hyphomycetes.					
CYLINDRIUM FLAVOVIRENS, Bon. On fallen leaves. ...		x		x	x
TRICHODERMA LIGNORUM, Tode. On dead wood. ...		x			
RAMULARIA CALCEA, Desm. On <i>Nepeta Glechoma</i> .					x
FUMAGO VAGANS, Pers. On leaves of evergreen shrubs.					x
ISARIA FARINOSA, Dicks. On dead pupæ of Lepidoptera.			x	x	x
ANTHINA FLAMMEA, Fr. On decaying leaves. ...	x				
TUBERCULARIA VULGARIS, Tode. On dead bark. ...	x		x	x	x

ADDENDA.

The results of the forays for 1906 were too late to be inserted in the foregoing list, but the new records are as follow. The excursions were to the woods at Hawkhead, 29th September, Drumpellier, 6th October, and Torrance (East Kilbride), 13th October. To these are added the records of a visit by Mr. D. A. Boyd and myself, to Montgreenan Woods, on 20th October.

	Hawkhead.	Drumpellier.	Torrance.	Montgreenan.
HYMENOMYCETES.				
Agaricini.				
MYCENA PTERIGENA, Fr. ...			×	
M. CAPILLARIS, Schum. ...			×	×
OMPHALIA STELLATA, Fr. ...				×
PLEUROTUS DRYINUS, Pers. ...			×	
P. PORRIGENS, Pers. ...				×
ENTOLOMA RHODOPOLIUM. ...				×
LACTARIUS DELICIOSUS, Fr. ...				×
L. PALLIDUS, Fr. ...			×	
Polyporei.				
POLYPORUS CÆSIUS, Fr. ...				×
FERRUGINOSUS, Fr. ...				×
SANGUINOLENTUS, Fr. ...			×	
Hydnei.				
PHLEBIA VAGA, Fr. ...		×		
Thelephorei.				
CORTICIUM INCARNATUM, Fr. ...				×
Clavariei.				
CLAVARIA FISTULOSA, Fr. ...				×
GASTROMYCETES.				
Lycoperdeæ.				
LYCOPERDON PERLATUM, Pers. ...				×

MICRO-FUNGI.

Phycomycetes.

CYSTOPUS CANDIDUS, Pers. On *Capsella Bursa-pastoris*. ...

PHYTOPHTHORA INFESTANS, Mont. On *Solanum tuberosum*.

Ustilagineæ.

PROTOMYCES PACHYDERMUS, Thüm. On *Taraxacum officinale*.

Uredineæ.

PUCCINIA SANICULÆ, Grev. On *Sanicula Europæa*.

P. CARICIS, Schum. On *Carex pendula*.

P. SUAVEOLENS, Pers. On *Cnicus arvensis*.

COLEOSPORIUM TUSSILAGINIS, Lév. On *Tussilago Farfara*.

Discomycetes.

HELVELLA MACROPUS, Pers. On the ground.

LEOTIA LUBRICA, Scop. On the ground. ...

HUMARIA GRANULATA, Bull. On cow-dung.

HELOTIUM CITRINUM, Hedw. On fallen branches.

CIBORIA LUTEO-VIRESCENS, Rob. On decaying stems of *Acer*.

CYATHICULA CORONATA, Bull. On a dead herb-stem.

CHLOROSPLENIUM ÆRUGINOSUM, Fl. Dan. Ascophores on
a fallen trunk.

LACHNEA SCUTELLATA, Linn. On rotten stumps....

ASCOBOLUS VINOSUS, Berk. On rabbit-dung. ..

BULGARIA INQUINANS; Pers. On a fallen trunk. . .

ORBILIA LEUCOSTIGMA, Fr. On rotten wood. . .

PSEUDOPEZIZA TRIFOLII, Bern. On *Trifolium repens*.

LOPHODERMIIUM PINASTRI, Schrad. On dead pine-leaves....

DICHÆNA QUERCINA, Pers. On living bark of *Quercus*.

Perisporiaceæ.

CAPNODIUM SALICINUM, A. and S. As Fumago, on *Salix*

<i>Caprea.</i>
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C. QUERCINUM, Pers. As Fumago, on *Quercus Robur*. ...

Pyrenomycetes.

HYPOCREA MORIFORMIS, C. and M. On a fallen trunk.

NECTRIA CINNABARINA, Tode. On dead bark. ...

N. COCCINEA, Pers. On dead bark of *Fagus*. ...

PHYLLACHORA GRAMINIS, Pers. On *Bromus asper*.

P. PODAGRARIÆ, Roth. On *Ægopodium*. . .

MELANCONIS STILBOSTOMA, Fr. On dead bark of *Betula*

SPHÆRELLA RUMICIS, Desm. On *Rumex obtusifolius*.

LÆSTADIA FAGINEA, Awd. On fallen leaves of *Fagus*.

[illegible]

	Hawkhead.	Drumpeilic.	Torrance.	Montgreenan.
XYLARIA HYPOXYLON, Linn. On rotten wood. ...	x	x	x	x
DIATRYPELLA VERRUCIFORMIS, Ehrh. On dead branches of <i>Fagus</i>				x
DIATRYPE STIGMA, Hoffm. On dead bark of <i>Crataegus</i>				x
Sphærospideæ.				
SEPTORIA STACHYDIS, Rob. and Desm. On <i>Stachys sylvatica</i> .				x
MELASMIA ACERINA, Lév. On leaves of <i>Acer</i>	x	x	x	x
Melanconieæ.				
MELANCONIUM BICOLOR, Nees. On dead bark of <i>Betula</i>				x
ASTEROSPORIUM HOFFMANNII, Kze. On dead bark of <i>Fagus</i> .		x		
Hyphomycetes.				
SEPEDONIUM CHRYSOSPERMUM, Bull. On rotten <i>Boleti</i>			x	x
TRICHOTHECIUM ROSEUM, Link. On dead bark of <i>Fagus</i> .		x		
TORULA OVALISPORA, Berk. On dead wood. ...			x	

THE BIRDS OF ROUKEN GLEN PARK.

BY JOHN ROBERTSON.

(Read 1st June, 1906.)

ROUKEN GLEN Park is suitable for many species of birds. As cover is good, and the glen proper is well sheltered, most of our woodland species are to be found. All our local warblers, except two, the wood warbler and lesser whitethroat, occur almost annually.

The Capelrig Burn runs through the park, connecting a small dam at the head of the glen with Deaconsbank Dam at the foot.

At present this stream is not pure, the smell given off some days by bleaching chemicals being very strong. It is to be hoped that the Corporation of Glasgow will take early steps to put a stop to the pollution of this burn. Not many years ago it was a fine trout stream, but no trout could survive in it now.

The public have recently been prohibited from fishing on the upper reaches of this stream, as well as the Brother Loch, from which it issues, so that the Glasgow people have a right, which can be legally enforced, to demand that the reach which belongs to themselves shall be free from pollution.

The kingfisher, dipper, and grey wagtail flit up and down the burn, and coots and waterhens are conspicuous on the dams.

The list which follows is made up of seventy-four species, but that is probably considerably short of the actual number which visit Rouken Glen Park, as I made no notes of birds in general on my visits. I was more interested in the warblers than the other birds. There are many birds in the list which one must naturally expect will soon vanish from this locality, now that the public are admitted in their thousands, but, on the other hand, a larger number are likely to remain denizens of the Rouken Glen Park for years to come.

Mistle Thrush (*Turdus viscivorus*, L.)—This, the largest of our thrushes, is pretty much in evidence in the grounds in the earlier months of the year. A few pairs nest; and the bird is in song

from January, or even earlier, till the end of May. The song is somewhat like that of the blackbird, but wilder and louder, and the single phrase of which the song consists is repeated rapidly, not—as in the case of the blackbird—leisurely, and with a pause between each phrase.

Song Thrush (*Turdus musicus*, L.)—Here, as in other woodland districts, our commonest thrush, and perhaps the finest singer among all our song birds. In an open season the song may be commenced at Christmas, and is continued, by some individuals, at least, until July.

In winter the song thrush is apparently absent from the Rouken Glen, but that there are nearly always a few birds present is proved by the fact that a mild day usually induces a few birds to burst into song.

The nest of the song thrush is a beautiful structure made of rootlets, coarse grass, or small twigs, and neatly lined inside with cow droppings or decayed wood; the whole so strong and firm that it resembles the half of a cocoanut shell. Among all the song thrushes' nests I have seen I have never yet observed one lined with mud.

Redwing (*Turdus iliacus*, L.)—This thrush visits us in winter in small flocks, and it occurs here quite commonly. The first intimation of its arrival is usually its note, "see you," from overhead on some dark October night, as the birds are finding their way to their winter quarters in this country.

Fieldfare (*Turdus pilaris*, L.)—Another winter thrush, and although often seen in the Rouken Glen, much less common than the redwing. It is more a bird of the open and upland country, the name fieldfare being from the Anglo-Saxon, and meaning the farer, or wanderer over the fallow, or untilled ground.

Blackbird (*Turdus merula*, L.)—Next to the song thrush in point of numbers, the blackbird is usually in song from March till June, and being rather more hardy than that species it is constantly to be seen in winter, even in hard weather.

Whinchat (*Pratincola rubetra* (L.))—A summer visitor quite common in the neighbourhood, and often visiting the grounds of Rouken Glen.

Redstart (*Ruticilla phoenicurus* (L.))—Another summer visitor, but it has only been noticed very rarely, in spring, on the way to its breeding quarters in some other part of the country.

Redbreast (*Erithacus rubecula* (L.))—The robin is abundant at all seasons, and it would be difficult to single out a week of the whole year in which its thin, high-pitched song may not be heard.

Common Whitethroat (*Sylvia cinerea* (Bech.))—This species arrives about the beginning of May and leaves again by September. It is a common bird in the grounds, frequenting the trees and thickets, and many pairs nest.

Blackcap (*Sylvia atricapilla* (L.))—This fine warbler is heard every season from the middle of May on, but only a pair or two nest.

Garden Warbler (*Sylvia hortensis* (Bech.))—The garden warbler arrives from 6th May on, and is more numerous than the blackcap; six or seven males may be heard in song on a May morning. The song is lower and more gurgling than that of the blackcap, but it requires very considerable practice and patience to be able to discriminate between the songs of these two species.

Goldcrest (*Regulus cristatus*, Koch.)—The golden-crested wren, the smallest of British birds, is common, especially among the conifers. It is always present, summer or winter, mild weather or severe frost; and in most seasons not less than half-a-dozen pairs nest within the bounds of Rouken Glen Park.

Chiffchaff (*Phylloscopus rufus* (Bech.))—This is only a passing visitor in April or May, its note, "chiff chaff," being often heard among the trees near the foot of the glen. I have never known it to nest here.

Willow Warbler (*Phylloscopus trochilus* (L.))—The commonest of all our warblers arrives from 8th April on. It is abundant everywhere, and in May its silvery little song may be heard on every hand. Even throughout August a few individuals are in song, but the song is then much lower and softer than in April or May.

Sedge Warbler (*Acrocephalus phragmitis* (Bech.))—This chattering warbler arrives about the end of April, and keeps pretty much among the willows and other bushes by the edge of the water. Only a few birds are to be found in the glen. The song consists of a few harsh "churring" notes of its own, intermixed with the notes of all the commoner birds, which it mimics admirably. On warm, close nights it sings all through the night,

and if it should be silent a stone thrown among the bushes, or any noise, will set it a-going. It is this species, singing at night, which is often mistaken in Scotland for the nightingale, a bird which has never been known to occur on this side of the border.

Grasshopper Warbler (*Locustella naevia* (Bodd.))—The grasshopper warbler has occurred a few times in May, just on the fringes of the park. Its curious song, best heard in the evening or early morning, is exactly like the sound of the reel of a fishing-rod being run out continuously.

Hedge Sparrow (*Accentor modularis* (L.))—This inconspicuous little bird may be seen in the park all the year round, and its pleasant warbling song may be heard in December, when nearly all birds are mute. It has a plaintive call note, which, heard through a wet December fog, adds a feeling of dreariness to the somewhat desolate days we have in that month. It has another curious sleepy note which conveys a feeling of drowsiness to the listener.

Dipper (*Cinclus aquaticus*, Bech.)—This lively bird, with its pure white breast, may be seen flitting up and down the stream emitting its call note, "zeet zeet." It has a pleasant, thrush-like song, which may be heard in winter when snow is on the ground and the streams half-frozen.

Long-tailed Titmouse (*Acredula rosea* (Blyth))—This pretty little bird, somewhat resembling a miniature magpie, is sometimes seen, but although it has nested several times in the neighbourhood, I have never seen its nest in Rouken Glen.

Great Titmouse (*Parus major*, L.). Coal Titmouse (*Parus ater*, L.). Blue Titmouse (*Parus caeruleus*, L.)—These three tits are all resident and nesting species in the Rouken Glen Park.

Wren (*Troglodytes parvulus*, Koch.)—The wren is a common Rouken bird, and its cheery song may be heard in every month of the year.

Tree Creeper (*Certhia familiaris*, L.)—A few birds are often present, and in some seasons a pair nests in the glen.

White Wagtail (*Motacilla alba*, L.)—This wagtail is sometimes seen by the margin of Deaconsbank Dam in spring, on its way to more northern climes.

Pied Wagtail (*Motacilla lugubris*, Tem.). Grey Wagtail (*Motacilla melanope*, Pallas.). Yellow Wagtail (*Motacilla raii* (Bona.))—

A few pied wagtails may be seen, while the grey wagtail frequents the stream where it nests. The yellow wagtail, a summer visitor to the surrounding fields, comes in to the margins of the dams to bathe and get whatever food it can.

Meadow Pipit (*Anthus pratensis* (L.)). Tree Pipit (*Anthus trivialis* (L.))—The meadow pipit is at times very common in the grounds, and a few pairs of the tree pipit, a summer visitor, occur.

Spotted Flycatcher (*Muscicapa grisola*, L.)—This, the latest of our summer visitors to arrive, is not usually noticed before the middle of May. Indeed, the bird is more in evidence in autumn than early summer.

Swallow (*Hirundo rustica*, L.). House Martin (*Chelidon urbica* (L.)). Sand Martin (*Cotile riparia* (L.))—Our three species of swallow may often be observed hawking insects over the dams or above the trees from April till October. The swallow and sand martin are more numerous than the house martin, of which only in autumn are numbers seen.

Greenfinch (*Ligurinus chloris* (L.))—Very common. The greenfinch begins to sing about the middle of March and continues till August.

House Sparrow (*Passer domesticus* (L.))—Abundant.

Chaffinch (*Fringilla cœlebs*, L.)—Vies with the greenfinch in point of numbers. The song of the chaffinch is commenced a little earlier and finished a month or six weeks sooner than that of the greenfinch.

Lesser Redpoll (*Linota rufescens* (Vieill.))—The lesser redpoll is sometimes seen in winter or early spring.

Yellow Bunting (*Emberiza citrinella*, L.). Reed Bunting (*Emberiza schoeniclus*, L.)—Both these species are well known birds in the grounds, although the reed bunting is rather scarce, only a pair or two occurring by the edge of the dams, oftenest at the one at the head of the glen. The yellow bunting is a most persistent singer. The song is usually started in February, and even in October—long after most birds are songless—the melancholy wail of some tardy yellow-hammer may be heard.

Starling (*Sturnus vulgaris*, L.)—Common. Perhaps one point in favour of this common but beautiful bird is the fact that it sings a great deal when other birds' songs are few and far between.

Magpie (*Pica rustica* (Scopoli))—The magpie still nests on Corporation ground, and may often be seen or heard in the vicinity.

Jackdaw (*Corvus monedula*, L.). Rook (*Corvus frugilegus*, L.)—Both these species are, of course, quite common.

Carion Crow (*Corvus corone*, L.)—Only once observed—in early spring.

Sky Lark (*Alauda arvensis*, L.)—A common bird in the vicinity, and its song may often be heard overhead. It is usually in song from February till July, and then resumes for a short time in October.

Swift (*Cypselus apus* (L.))—Often seen flying above Deacons-bank Dam in pursuit of insects.

Kingfisher (*Alcedo ispida*, L.)—May often be seen darting along the stream, where a pair or two nest nearly every season, either within the glen itself, or a short distance beyond the boundaries.

Cuckoo (*Cuculus canorus*, L.)—Though not a common bird here, the well-known note of the cuckoo may often be heard in the park.

Long-eared Owl (*Asio otus* (L.)). Tawny Owl (*Syrnium aluco* (L.))—Both these owls occur but sparingly.

Sparrow Hawk (*Accipiter nisus* (L.))—Frequents the woodlands of the neighbourhood, and is now and then seen here.

Heron (*Ardea cinerea*, L.)—Formerly the glen was seldom without a heron or two fishing in the stream, but the works above Newton Mearns seem to use a stronger brand of chemicals now, which being discharged into the Capelrig Burn has proved disastrous to the trout and minnows, so that the heron has to go elsewhere.

Wild Duck (*Anas boschas*, L.). Teal (*Nettion crecca* (L.)). Tufted Duck (*Fuligula cristata* (Leach.)). Pochard (*Fuligula ferina* (L.))—A few of all these ducks occur on the dams, the wild duck and teal frequently, but the tufted duck and pochard rarely.

Ring Dove (*Columba palumbus*, L.)—Many wood pigeons nest in and around the grounds, and their plaintive note may often be heard. The note has been rendered "*Taffy tak two coos*," and on nearly every warm or close day, from January till August, the ring dove may be heard urging Taffy, over and over again, to "*Tak two coos*."

Pheasant (*Phasianus colchicus* (L.)). Partridge (*Perdix cinerea*, Latham.)—Both the pheasant and the partridge occur in the park, the latter rather rarely, but neither is likely to increase in numbers now.

Corncrake (*Crex pratensis*, Bech.)—The corncrake comes to the neighbouring fields in April, keeping in about the plantations and hedge bottoms at first, and then occupying the grass lands later.

Water Rail (*Rallus aquaticus*, L.)—I have only twice seen this shy and retiring species, at the edge of Deaconsbank Dam.

Waterhen (*Gallinula chloropus* (L.))—This is a common species in the glen. It is always present, summer or winter.

Coot (*Fulica atra*, L.)—About four pairs of coots inhabit the dams as long as the water is not frozen over, when they repair to larger sheets of water, or to the coast.

Lapwing (*Vanellus vulgaris*, Bech.)—The lapwing is a common species in the surrounding fields, and often comes in to the water to drink or bathe.

Woodcock (*Scolopax rusticula*, L.)—A few birds are sometimes seen, but only in winter.

Common Snipe (*Gallinago cælestis* (Frenzel))—The snipe is often seen in winter.

Common Sandpiper (*Totanus hypoleucus* (L.))—This engaging species is frequently by the water's edge from April till August.

Green Sandpiper (*Totanus ochropus* (L.))—This rare species I have only seen once—in April—at the dam above the falls.

Redshank (*Totanus calidris* (L.))—Often comes into the muddy margins of the dams to feed.

Black-headed Gull (*Larus ridibundus*, L.). Herring Gull (*Larus argentatus*, Gmelin). Lesser Black-backed Gull (*Larus fuscus*, L.)—These three gulls come about the dams, the black-headed oftenest, the other two only occasionally.

Little Grebe (*Podiceps fluviatilis* (Tunstall))—This species nests on the dams, and is nearly always present, unless frozen out in winter.

ADDITIONS TO AUGUST, 1907.

The following four species fall to be added to the list, bringing the total number for Rouken Glen Park up to seventy-eight.

Brambling (*Fringilla montifringilla*, L.)—On 27th January, 1907, I saw a fine male brambling feeding along with some chaffinches in the park; and on 9th, and again on 16th February, I saw a single bird roosting in small thorn trees, where many greenfinches and chaffinches roost in winter. On one of these dates, 9th February, about twenty birds, which were probably bramblings, were disturbed from a clump of evergreens, where they had gone to roost, but in the bad light, just at dusk, I could not see them sufficiently well to make identification certain. On 8th April, a late date for this winter visitor, Mr. John Paterson saw about a dozen bramblings on a lime tree near the waterfall, sunning themselves in bright, golden light towards sundown.

Golden-eye (*Clangula glaucion* (L.))—On 10th February, 1907, I saw a young male golden-eye on Deaconsbank Dam. I subsequently saw the same bird there on several occasions. It had thrown aside much of its usual shyness and seemed quite at ease, diving for food and associating with a few pochards that visited the dam frequently.

Golden Plover (*Charadrius pluvialis*, L.)—This species occurs in some numbers in winter in the fields on the east and west sides of the park, and is often seen passing over, although it is not likely to alight, as it is a bird of the open.

Curlew (*Numenius arquata* (L.))—I find from my notes that on 1st May, 1898, I saw a curlew, which was calling as it flew west at a low elevation over the park. I had overlooked this note when I read the paper to the society.

In conclusion, I may say that this summer (1907), after the park has been open for over a year and been visited by hundreds of thousands of persons, I could find no appreciable difference in its bird life. Of the seventy-eight species recorded I have observed sixty-two this year.

I could not reckon the chiffchaff among the birds that breed in the glen until this season, when two pairs of this somewhat local warbler remained to nest.

EXCURSIONS TO THE ISLANDS OF BUTE AND GREAT CUMBRAE.

BY JOHN ROBERTSON.

OWING to the comparative inaccessibility of these islands they are not suited for Saturday afternoon excursions, and the discomfort travelling there on any of the Glasgow holidays has doubtless prevented the Society having more whole-day excursions to the delightful island of Bute and the not less interesting Cumbraes, than would otherwise have been the case.

The first excursion was to the Great Cumbrae on Saturday afternoon of 7th July, 1888, and the record states that five members attended, and that among other plants the following were found:—*Ranunculus Flammula*, *Geranium dissectum*, *Anthyllis Vulneraria*, *Sedum anglicum*, *S. acre*, *Buda rubra*, *Daucus Carota*, *Aster Tripolium*, and *Scutellaria galericulata*.

On 13th April, 1891 (Glasgow Spring Holiday), the Great Cumbrae was again visited by a party of about thirty-five members and friends. Favoured by good weather this outing was much enjoyed. Landing at Keppel Pier the party divided into different sections, and thus succeeded in covering a considerable area of the island, including the foreshores as far round as Balloch and Fintry Bay, and also the central uplands and the wood behind the West Bay, Millport. Owing to the protracted severe weather the deciduous trees were all quite bare, but the following plants were found in flower:—

RANUNCULUS FICARIA, L.	ADOXA MOSCHATELLINA, L.
CARDAMINE HIRSUTA, L.	TARAXACUM OFFICINALE, Web.
SISYMBRIUM THALIANUM, Hook.	TUSSILAGO FARFARA, L.
COCHLEARIA OFFICINALIS, L.	BELLIS PERENNIS, L.
VIOLA CANINA, L.	NEPETA GLECHOMA, Benth.
STELLARIA MEDIA, L.	PRIMULA VULGARIS, Huds.
OXALIS ACETOSELLA, L.	MERCURIALIS PERENNIS, L.
CHRYSOSPLENIUM OPPOSITIFOLIUM, L.	ULMUS MONTANA, Sm.
	CORYLUS AVELLANA, L.

The following were also noted, but not in flower:—*Arenaria trinervia*, L., *Geranium lucidum*, L., *Alisma ranunculoides*, L., and *Zostera marina*, L. The ivy, *Hedera Helix*, L., was in fine fruit on the cliffs. The following ferns were gathered:—*Asplenium Ruta-muraria*, L., *A. Adiantum-nigrum*, L., and *Scolopendrium vulgare*, Sm.

The frequency and beauty of the poet's lichen, *Parmelia variatina*, *P. saxatilis*, and *Evernia prunastri* chiefly attracted attention in lichens. Some puff balls were also gathered, but in seaweeds, partly owing to the state of the tide, nothing was done.

Some of the party engaged in dredging operations in Millport Bay.

About thirty species of birds were noted, amongst which were the heron, golden plover, and oyster-catcher, and most of our commoner local inhabitants, but our spring and summer visitors were still conspicuous by their absence.

Mr. John Stewart took a few photographs, mostly of geological interest, including a view of the trap dyke known as the Lion Rock.

Under the most favourable conditions of wind and weather, Mount Stuart was visited on 7th April, 1890 (Glasgow Spring Holiday).

This excursion had been arranged by the Zoological Society of Glasgow, who had kindly invited our Society to participate. The rendezvous was Rothesay, and on arrival there the company immediately proceeded by the high road to Mount Stuart policies.

On old walls by the roadside a great profusion of the dimple-wort, *Cotyledon Umbilicus*, was noted. After entering Mount Stuart grounds, and on the way to the mansion house, many great cherry and Portugal laurels attracted attention. The long avenue of lime trees, known as the Lime Walk, with its vista closed by the sea, was much admired.

Proceeding, a heron on the wing was noticed, and inquiries being started, it appeared that there was a small heronry in the policies, which was then visited. Under the nesting place the bones of an adult heron and some fragments of eggs were discovered.

After passing the house, an example of the oriental plane arrested attention.

A little later the wallaby enclosure was reached. Some time was spent here while the wallabies, five in number, were being fed by the keeper, and the members of the photographic section endeavoured to photograph this interesting group. Some good results were eventually secured. The wallabies were interesting creatures, and one female was carrying a young one in her pouch.

The beaver dams were then visited, and successfully photographed. Much interesting information on the Mount Stuart beaver colony, which is now extinct, is given in a paper by Joseph Stuart Black, late keeper to the Marquess of Bute, published in the "Journal of Forestry and Estates' Management," and since reprinted in pamphlet form by A. Westwood & Son, Cupar-Fife (1887). The party returned by the moor road to Rothesay. There were present from this Society about sixty, and from the Zoological Society about ten, members and friends.

On 19th May, 1898, Mount Stuart was visited a second time. Landing at Craigmore in beautiful weather, the party (about twenty-two) made their way along the shore road to Mount Stuart. The blighting effect of the cold east winds on the tender leaves and shoots of some of the trees—particularly the horse-chestnut—was noticeable along the shore.

Within the policies there was nothing noted that had not been observed at our former visit. Most of the party returned to Rothesay, via Craigmore, but several members walked over to Stravanan Bay, where a ringed plover's nest and several oyster-catchers' nests were seen.

During the day about forty-two species of birds were observed, including the wood warbler, spotted flycatcher, and grey wagtail at Mount Stuart, and the tree pipit near Birgisdale schoolhouse.

On Saturday, 23rd June, 1894, an excursion was arranged to Kilchattan Bay, by the 10.30 a.m. train, via Fairlie.

Arriving at Kilchattan Bay some of the party set out for the Garroch Head. Notwithstanding the inclemency of the weather the walk proved a most enjoyable and exhilarating one. Near the pier red sandstone was prominent. This sandstone, not being in layers and being soft, is not used for building purposes.

Interspersed in the sandstone are numerous trap dykes, which increase in number, till at the Garroch Head the ground is composed of magnesium trap.

Returning to Kilchattan, the party had dinner and the conductor then displayed his spoils, which included hydrozoa, hermit crabs, *Pagurus Bernhardus*, L., *Corina pusilla*, *Clava multicornus*, *Certularia punica*, *C. abietina*, *Diphesia rosacea*, etc.

The weather having now improved, the party had a very enjoyable walk round the bay. In the course of the walk two broods of oyster-catchers were very conspicuous. On the shore, besides a number of ordinary shells, a very large otter shell, *Lutraria elliptica*, was found.

After visiting two ancient tumuli, and noting some of the various raised beaches, several of the party visited the glacial clay-bed, at present being worked; and described by Mr. Robertson in the "Transactions of the Geological Society of Glasgow." In this bed was seen a magnificent example of the different kinds of deposits set down in deep and in shallow waters. The deposit in deep water formed a clay of absolutely fine grain, while the deposit in shallow water was much coarser, with shells interspersed.

Mr. Johnstone Shearer reported the following plants:—

DRABA VERNA, L.	ROSA SPINOSISSIMA, L.
NASTURTIUM OFFICINALE, R.	SEDUM ANGLICUM, Huds.
Br.	S. ACRE, L.
RAPHANUS RAPHANISTRUM, L.	COTYLEDON UMBILICUS, Huds.
R. MARITIMUS, Sm.	VERBASCUM THAPSUS, L.
SISYMBRIUM THALIANUM, Hook.	MIMULUS LUTEUS, L.
LYCHNIS VESPERTINA, Sibth.	ERYNGIUM MARITIMUM, L.
SILENE MARITIMA, With.	SAMOLUS VALERANDI, L.

And abundance of the usual seaside plants, such as *Armeria*, *Glaux*, *Honckenya*, etc.

For the ornithological section, Mr. John Paterson reported:—"Under the most unfavourable conditions thirty-five species were noted. In the fields on the north side of the bay the corn bunting was of frequent occurrence. On the south side the kestrel and the wheatear were seen. A number of ducks, apparently tufted ducks—*Fuligula cristata*—were observed."

On 31st August, 1901, another excursion to Kilchattan Bay and South Bute was arranged, under the leadership of Mr. John Smith, Kilwinning, who reported—

“From the pier we went through the village and along the old road that leads through the north end of the Suidhe Plantation. The Suidhe (seat) is a trap eminence rising to 517 feet, and from its summit a magnificent view is to be obtained of the surrounding district, of water, of island, and of mountain.

“Reaching the main road we turned south by Lubas, and when near Dunagoil farmhouse went down a farm road to Dunagoil Bay. Bosses of trap rock are numerous in this district, and on the top of one of them is situated *dun na goil*, that is, ‘the stronghold of the stranger.’ Its north and north-east sides are defended by the vertical walls of the trap, but its south-west side having sloped towards the firth has had a vitrified wall formed along the edge of its summit. What remains of this wall is seen to be soldered firmly together into a slag-like mass not unlike what the inside of an old lime kiln represents. But the enemy has been here, and a large part of the wall has been thrown down; masses of it lying on the slope already referred to. The top of the rock has probably been divided into two compartments, the south-east one having also been defended by a vitrified wall, and as this is the weakest part (the rock here sloping gently to the south-east) it would be absolutely necessary that the defences here should be of the very strongest kind. It is also likely that the rest of the fort should have been defended even from ‘wind and weather’ by some kind of wall, but whatever it may have been composed of, it has entirely disappeared.

“As to how the vitrification in old fort walls was produced there have been several opinions, some people even going the length of thinking that it was quite accidentally produced by the frequent lighting of beacon fires; but in some I have seen the vitrification has clearly been a matter of design, and Dunagoil is of the number.

“Having viewed from the top of the old fort the rough-and-tumble country to the south-east, a bit of trap land, and seascape, which for irregularity of outline it would be difficult to match elsewhere, we proceeded southwards along the coast for about a mile to Wamh Phadrich. This is a cave situated about forty vertical feet above sea-level, hollowed in a bed of volcanic ash and excavated by the waves, probably during the forty feet raised-beach period. We proceeded to examine its contents, and soon found a few

split bones which had been broken from those of some large animal. This was our resting and turning point, and having found a pass in the trap cliffs we reached one of those curious, smooth, grassy glades which lie between the rough outcroppings of the trap rocks near South Garrochty.

"Right in front of us was a very remarkable hill, and a certain gentleman we met furnished us with a good cock-and-bull story of the marvellous kind concerning it. South Bute occupies but a small area, only some four square miles, but from the irregularity of its surface it presents from many points of view landscapes worthy of the brush of the painter, the admiration of the excursionist, or the camera of the photographer.

"Turning to the right by the road which leads to the Plan farm, we found a footpath which took us to the ruin of St. Blane's Chapel.

"The arrangements here are peculiar, the church and churchyard being situated on the top of a mound raised some distance above the general level of the ground. Some repairs and additions have lately been made on the ruins, but it may take centuries 'nibbling of the tooth of time' to bring them into harmony with the rest of the ruins.

"To the south-east of the churchyard a bit of ground has been excavated to a shallow depth, exposing some exceedingly primitive structures. What we dubbed the *treasure chest* is a hole in the ground lined with four rough stones and covered by a stone lid, which has a convenient notch in one side of it, so as to allow a person to put in or take out any small article without being at the trouble of raising the stone.

"Just to the west of the church there is a cliff of trap rock, and close up to it there are two remarkable structures built entirely without lime. The south one may have been the original kil or cell of St. Blane, and the north one—called the cauldron—was probably where his servants resided. It is sub-circular in outline, and the boulder-built walls are ten feet thick. Inside of it one of the party detached a large fragment of an under hand-millstone—the 'sitter.'

"Proceeding from the base of the cliff, at the north side of the cauldron, there is the root of a very thick, old, dry-stone wall, which, curving round, continues in a straight line for a considerable

distance towards the south, and probably at one time enclosed the original territory of St. Blane.

"We now set out on an adventure across the hills, and none of the party will readily forget this. Having been nearly swamped amongst the tall brackens on either side of Glen Callum, and passing the ruin of what the Ordnance map has set down as a 'castle,' we descended on the east shore. Amongst interesting features of a geological nature there is here a famous patch of 'columnar sandstone.'

"During the excursion an exceptional number of scarce plants were seen, and there were few of the party who did not obtain something new to them. The chief plants were :—

SAPONARIA OFFICINALIS, L.	CHRYSANTHEMUM SEGETUM,
SILENE MARITIMA, With.	L.
SAGINA NODOSA, Fenzl.	MENTHA AQUATICA, L.
HYPERICUM HUMIFUSUM, L.	SAMOLUS VALERANDI, L.
GERANIUM MOLLE, L.	CHENOPODIUM BONUS-HEN-
EPILOBIUM PARVIFLORUM,	RICUS, L.
Schreb.	POLYGONUM HYDROPIPER, L.
CIRCÆA LUTETIANA, L.	ASPLENIUM ADIANTUM-NIG-
COTYLEDON UMBILICUS, L.	RUM, L.
SEDUM ANGLICUM, Huds.	CYSTOPTERIS FRAGILIS,
CARDUUS ACANTHOIDES, Sm.	Bernh."

Kilchattan Bay was the starting point of a third excursion on Easter Monday, 16th April, 1906. Some twenty-four members attended. The route followed was much the same as on the Society's previous visit to Kilchattan Bay, but the outing was completely marred by bad weather.

The standing stones in Blackpark Plantation were visited. These are three upright blocks, of which really nothing authentic is known. The heavy rain rendered successful observation out of the question, and there was nothing noteworthy to report. For the entomological section Mr. Ross, who had been down over the week-end, reported :—

"The sunshine of Saturday forenoon brought out many flies among the willows near the pier. At no corresponding period of any year have we seen such numbers on the wing. In addition to these, bees of various kinds swarmed about the willow catkins.

Although the number of species of Diptera is not great, individuals, especially of the 'bluebottle' and 'greenbottle' flies, were abundant. The following were captured :—

Family Syrphidæ.

CHILOSIA GROSSA, Fallén.
 PLATYCHIRUS ALBIMANUS, Fab.
 SYRPHUS COMPOSITARUM, Ver.
 S. PUNCTULATUS, Ver.
 S. TORVUS, O.-S.

Family Anthomyiidæ.

HYETODESIA MARMORATA, Ztt.

Family Muscidæ.

LUCILIA CORNICINA, Fab.
 CALLIPHORA ERYTHROCEPHALA,
 Mg.

Family Scatomyzidæ.

SCATOPHAGA VILLIPES, Ztt.
 CERATINOSTOMA OSTIURUM,
 Hal."

On 29th August, 1903, an outing was arranged to St. Ninian's Bay, Bute.

The showery morning probably kept some members from joining, as only ten, two of them being ladies, put in an appearance.

Leaving Rothesay pier the route taken was by the Kilchattan road, along which the party walked for about four miles to Birgidale School. The view on the way embraced Loch Fad on the right, and Loch Ascog on the left, and before long the rugged peaks of Arran rose in front and were in sight the whole day.

The first object that attracted attention along the road was the abundance of a lichen, probably *Parmelia parietina*, on which the fructification was finely developed.

Although rather late there was a fine display in the hedges, in places, of the honeysuckle, *Lonicera Periclymenum*, and along the roadside were seen good specimens of *Cerastium vulgare*.

In one place the leaves of the willow, *Salix purpurea*, covered with galls about the size of peas, attracted some notice.

Gnaphalium uliginosum was very plentiful by the roadside, and among the plants seen were *Eupatorium cannabinum*, *Erythræa Centaurium*, *Valeriana officinalis*, *Solanum Dulcamara*, and last, though not least, the uncommon *Senecio sylvaticus*.

Leaving the Kilchattan Bay road, the way was taken past Ambrismore, to the heather-covered and rocky point above Ardschalpsie. Having got over this point the road was left, and the party made across the fields to the shore, and from this point the ground was a paradise to botanists. On the higher ground were seen *Pimpinella Saxifraga*, *Matricaria Chamomilla* and

Gnaphalium sylvaticum, while lower down in the marshy ground *Anagallis tenella* was very plentiful, and *Pinguicula lusitanica* was not uncommon.

On the border land, between the shore and the higher ground, in the marshy places were found *Hypericum elodes*, *Triglochin maritimum*, *T. palustre*, *Alisma rununculoides*, and *Juncus uliginosus*, form *viviparus*.

The shore being reached, eager anticipations were once more satisfied. *Samolus Valerandi*, *Ligusticum Scoticum*, *Salicornia herbacea*, *Mertensia maritima* (the oyster plant), *Ænanthe Lachenalii* turned up in quick succession among the plants. A specimen of the seaweed *Odontholium dentatum* was found, but not in good condition.

On the rocks we got *Asplenium maritimum*, and *A. Adiantum-nigrum*.

The time running short the shore was left, and all made for the high road to Rothesay. On the way a fine plant of *Daucus Carota* was noted. What gave great pleasure was the finding, during the day, of five species of *Hypericum* in flower, viz.:—*H. elodes*, *perforatum*, *quadrangulum*, *humifusum*, and *Androsæmum*.

The last thing noted was a fine mushroom, *Agaricus arvensis*, which was found growing in the grass by the roadside.

THE FLORA OF THE ARROCHAR MOUNTAINS.

BY JOHN R. LEE.

(Read 1st December, 1905.)

FOR a considerable number of years past various members of the Andersonian Naturalists' Society have both singly, and in groups of two or three, or sometimes larger parties, made excursions to the Arrochar district, for the purpose of investigating the botany of the mountains around the head of Loch Long. The results of these observations have, from time to time, been brought before the Society, and many interesting and valuable details regarding the occurrence of particular species on these hills have been obtained. The chief interest of the district lies in the fact that it forms the only truly alpine region of any considerable extent within the drainage area of the Clyde; and although the Arrochar hills do not attain an altitude comparable with that of the mountains lying to the north of Loch Lomond, still they are sufficiently high to yield examples of the typical Arctic vegetation found on the more lofty summits in Scotland, and may be said to be fairly representative of Scottish mountains in general as regards their characteristic flora.

The present paper is an attempt to bring together the results of the observations hitherto made upon some of these hills, so far as they are sufficiently complete to be of value for future reference. As the information available with regard to some of the less accessible parts of the district is somewhat scanty, I have found it necessary to confine attention to a somewhat restricted area, and to adopt boundaries which, while fairly natural on the whole, are necessarily arbitrary and artificial at some points. The area which I propose to deal with exclusively in the present paper is that comprised within the following boundaries, viz.: On the south—the Glen Croe burn from its source to Loch Long, and the valley between Arrochar and Tarbet,



CROIS, FROM ARROCHAR.



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including that portion of the shore of Loch Long lying between the mouth of Glen Croe and Arrochar pier. On the west—the watershed running along the ridge of Ben Ime (and including the peak), dividing the streams draining to Loch Long from those draining towards Loch Fyne, and extending northward to the head of Loch Sloy, and the northern slope of Ben Vorlich. On the north—the base of Ben Vorlich eastward to Ardlui; the eastern boundary being formed by Loch Lomond, from Ardlui to Tarbet pier. I have not included any of the hills lying on the south side of the Tarbet valley, between Loch Lomond and Loch Long, but as these hills do not attain a high altitude, and nowhere afford a truly alpine flora, their exclusion does not seriously affect the purpose of this paper. It is with more hesitation that I have decided to leave out of account the interesting hills to the south and west of Glen Croe. By so doing several very interesting and important records of the rarer alpine species have to be passed by; but, as the information with regard to these hills is much less complete than is the case with the area included, I have thought it well to postpone dealing with these meantime. I might suggest to some of the members of the Botanical Section, whose knowledge of these localities is more extensive than my own, that a paper on similar lines to the present, dealing with the now popular “Argyll’s Bowling Green” and the specially interesting mountain of Beinn-an-Lochain, would be a valuable one.

The mountains included within the boundaries indicated are six in number, and lie in two parallel series running south-west and north-east. The three peaks included in the more southerly ridge are Ben Arthur, Ben Narnain, and Crois; those in the more northerly series are Ben Ime, Ben Vane, and Ben Vorlich. Besides these higher peaks there is the low hill of Cruach-Tarbet, locally known as “The Cruach,” which occupies the south-eastern corner of the district, forming the northern side of the Tarbet valley, and divided from the larger mountain masses by the two principal glens of the area. These glens are (1) Glen Loin, which forms the upper portion of the Loch Long basin, and extends for about two and a half miles in a north-easterly direction from the head of the loch between Crois and the Cruach; and (2) the deep valley of the Inveruglas, which in its lower part separates

the Cruach from Ben Vorlich, and in its upper portion extends for about three miles between the masses of Ben Vorlich and Ben Vane. The northern end of this valley, at an altitude of a little over 800 feet, is occupied by Loch Sloy, a lake about one and a half miles in length, and a little over two hundred yards broad at its widest part. By means of this deep valley the whole mass of Ben Vorlich is rather sharply separated off from the other hills; but, with the exception of this mountain, and the Cruach, all the other peaks are more or less connected by lofty ridges, their summits thus forming in reality only the different crowns of a single huge mountain mass. Three of these, namely, Ben Arthur, Ben Ime, and Ben Vane, are divided from each other, and from the other two by definite gullies, the largest of which is Coiregrogain, which extends upwards for about two miles from the Inveruglas, between the steep southern face of Ben Vane and the ridge of Ben Narnain, to the col between the latter mountain and Ben Ime, at an altitude of 2,200 feet. The peaks of Ben Narnain and Crois are connected by a high continuous ridge of roughly semi-circular outline, with precipitous rocks facing the south-east, this grand amphitheatre enclosing the great Corrie of Narnain, or Corrie-Sugach, one of the most magnificent bits of hill-scenery in the district.

The mountain streams are a feature of special interest from our present point of view, as they form an important hunting-ground of the botanist. The principal streams of the district are the following:—

1. The Inveruglas Water, a stream of considerable size, which drains Loch Sloy, and after a course of about three miles enters Loch Lomond at Inveruglas Farm, almost exactly opposite Inversnaid. The Inveruglas valley, already referred to, is the only piece of truly characteristic river-scenery in the district, and has many attractions for the lover of the picturesque and sublime.

2. The Allt-Coiregrogain, rising on the northern side of Ben Narnain, and, after being joined by a considerable stream which flows down the north-eastern side of Ben Ime, enters the Inveruglas near the foot of Crois.

3. The Glen Loin burn, chiefly remarkable for the fact that it flows, throughout the greater part of its length, between cultivated fields, an unusual feature in this wild hill-country.

4. Allt-Sugach, or the Succoth burn, one of the most interesting of the streams to the botanist, which rises in the great Corrie of Narnain, and flows down the steep face of the hill between the peaks of Narnain and Crois into Glen Loin, but entering the sea by a separate channel from that of the Glen Loin burn itself.

5. Allt-a-Bhalachain, or the "Sour Milk burn," occupying the gully between Ben Narnain and Ben Arthur. The source of this rather famous stream is an extensive swamp lying in the hollow between the two peaks, at an altitude of 2,100 feet, and offering many features of botanical interest, to which we shall have occasion to refer further presently.

Besides these there are several minor streams, especially on the eastern side of Ben Vorlich, as at Stuckindroin and Ardvorlich, but these have not yet received the same amount of attention.

The prevailing aspect of the vegetation throughout the greater part of the area is that of hill-pasture, the dominant species being grasses or grass-like plants. Heather-moors are nowhere extensive, the only considerable areas under heather being a large part of the Cruach, up to about 1,000 feet altitude, and a portion of the eastern slopes of Ben Vorlich, overlooking Loch Lomond. Woodland vegetation prevails on the banks of Loch Lomond, and on the side of the Cruach facing Glen Loin. There are also a few stretches of woodland in Glen Loin itself, one or two deep gullies near the head of the glen being, in particular, very densely wooded. The dominant trees in these woods are oak and birch, the former prevailing at a low elevation, whilst the birch becomes dominant on the hill slopes above the oak. The woodland areas do not reach to a high altitude except on Ben Vorlich; where, in the gully above Stuckindroin, the slopes are wooded up to nearly 1,500 feet. With the exception of the areas mentioned, the mountain sides are mostly treeless, except along the courses of the larger streams.

The hill-pasture, which covers by far the largest part of the district, is fairly uniform in character; its specific constitution varying, for the most part, within very narrow limits, as one or another species becomes dominant according to the nature of the soil; the variations in the latter being due to the presence of a

greater or smaller amount of humus, the quantity of moisture, or (to a lesser extent) the exposure and altitude.

The following list of plants forming the grass association will shew that it does not differ in any respect from that characteristic of Scottish hill-pasture in other districts. This particular list represents the species present on a piece of dry ground at an altitude of 2,000 feet on Ben Narnain, and may be said to be fairly typical of the hill-side vegetation throughout the district. The species are arranged in the order of numerical importance—not in systematic order:—

<i>Anthoxanthum odoratum.</i>	<i>Luzula campestris.</i>
<i>Aira flexuosa.</i>	<i>Vaccinium Myrtillus.</i>
<i>Festuca ovina.</i>	<i>Potentilla tormentilla.</i>
<i>Nardus stricta.</i>	<i>Carex</i> (sp.)
<i>Galium saxatile.</i>	<i>Juncus squarrosus.</i>

The principal dominant species in the grass association are the following four, viz.:—*Aira flexuosa*, *Nardus stricta*, *Anthoxanthum odoratum*, *Scirpus cæspitosus*. These four replace one another over the greater part of the moors—now one, and now another taking the dominant position. Other plants also become dominant in more restricted areas, such as *Juncus squarrosus*, or, in very wet places, *Juncus acutiflorus*. The secondary species, of course, vary greatly in numerical importance at different points, but, although differing in relative numbers, the same species are pretty constant throughout. The following list may be compared with the one already given. This represents a similar association on Ben Vane at 1,400 feet altitude (six hundred feet lower than the one selected on Ben Narnain)—

<i>Aira flexuosa.</i>	<i>Molinia cærulea.</i>
<i>Luzula campestris.</i>	<i>Galium saxatile.</i>
<i>Scirpus cæspitosus.</i>	<i>Juncus squarrosus.</i>
<i>Nardus stricta.</i>	<i>Anthoxanthum odoratum.</i>
<i>Potentilla tormentilla.</i>	

The presence of the *Molinia* in this list, and its absence from the former, which is the most striking difference, is not due to the difference in altitude, for this grass is common all over the moors, and forms part of the plant-carpet on the summits of Ben Vane and Ben Vorlich—both over 3,000 feet.

In order, however, to indicate the general effect of a greater altitude, I may give one more such list, this time representing a typical alpine pasture at 3,000 feet on Ben Ime :—

<i>Silene acaulis</i> (forming cushions here and there to the exclusion of other plants).	<i>Viola palustris</i> .
<i>Anthoxanthum odoratum</i> (dominant between the patches of <i>Silene</i>).	<i>Campanula rotundifolia</i> .
<i>Galium saxatile</i> .	<i>Alchemilla alpina</i> .
<i>Thymus Serpyllum</i> .	<i>Aira cæspitosa</i> , or <i>alpina</i> ? (in clumps).
	<i>Festuca ovina</i> , var. <i>vivipara</i> (in clumps).

The typically alpine species here are *Silene acaulis* (not found at a low altitude), and *Alchemilla alpina*. The other plants appearing here, and not included in the preceding lists, namely, *Thymus*, *Viola*, and *Campanula*, are common in the lower parts, but only become conspicuous members of the grass association at a high altitude.

At low altitudes, near the base of the hills, the grass association is necessarily much richer in species, but its general character is still very similar. One species of grass, however, not found at high elevations, becomes conspicuous here, namely, *Agrostis vulgaris*. *Holcus lanatus* is also frequent at low elevations.

From what has been said it will be apparent that there is considerable uniformity in the vegetation over the greater part of the district, and that, in considering the distribution of less common plants, one has to do with restricted portions of the hills to a large extent. What may be spoken of distinctively as the alpine flora of the district is most typically exhibited on the rocky cliffs towards the higher parts of the mountains, at elevations of 2,000 feet and upwards, on rock-ledges, amongst boulders and debris resulting from the weathering of the rocks, and on the stony parts of the moors near the summits.

Besides this more specially interesting alpine region, there are two localities included in the district to which I should like to make special reference in passing. The first is Loch Sloy, the flora of which lake, would, I believe, repay a more extensive investigation than it has yet received. The loch is situated, as already remarked, at over 800 feet altitude, between the steep sides of Ben Vorlich and Ben Vane, which rise abruptly from its margin on both sides; and many plants characteristic of the

alpine flora are common on its banks. One of its most striking botanical features is the great abundance of the beautiful water lobelia (*Lobelia Dortmanna*), which I do not remember ever having seen to such perfection in any other locality. The other place I wish to mention specially is the large swamp, already referred to, between Ben Arthur and Ben Narnain, which forms the source of the Allt-a-Bhalachain. I do not know if any of our members have ever botanized in this particular station to any extent, but I feel certain that it would repay an extensive examination. In July of this year I took a short survey of its margin when ascending towards Ben Ime, but the time at my disposal was not nearly sufficient to make an adequate search for plants. One of the most interesting species observed growing amongst the sphagnum here was *Vaccinium uliginosum*; whilst the bog-bean (*Menyanthes trifoliata*) was very abundant, this being an exceptional altitude at which to find this species—2,100 feet. The most abundant plant in the swamp (apart from sphagnum) is the graceful *Carex ampullacea*.

With regard to the six mountain peaks included in the area we are considering, it may be remarked that some have naturally received more and closer attention than others. A few notes regarding each of the hills may be in place here, as indicating the general distribution of the alpine plants.

The most southerly peak is Ben Arthur, more familiarly known as "The Cobbler," remarkable for the fantastic form of its broken, rocky summit, as seen from the east. This shattered ridge is roughly divided into three portions, the central one being the highest, with an altitude of 2,891 feet above sea-level. The whole of this mass, from about 2,000 feet upwards, presents, to the east and north, a series of rock-ledges and precipitous cliffs, broken by stretches of stony ground, with a thin covering of humous soil—a particularly favourable habitat for the growth of alpine forms of vegetation. The eastern slope, facing Arrochar, has been pretty well explored, but there is on the northern side a long talus-slope, extending from near the bank of the Allt-a-Bhalachain right up to the base of the gigantic, overhanging crag which forms the crown of the northern peak, amongst the innumerable large boulders of which many interesting plants have been found, and which would probably repay further searching.

Ben Narnain, immediately to the north of the "Cobbler," is 3,036 feet in height, and is remarkable for its curious flat table-like top, flanked, on the east and south, by precipitous cliffs, and by steep slopes on the north and west. The sides of this mountain are marked by great crags, in the crevices of which many interesting plants are found. Its north-eastern slope, above the gully of the Allt-Sugach, has been well explored, and most of the hill-plants of greatest interest in the district have been found in this region.

As already remarked, Ben Narnain is joined by the rocky ridge forming the boundary of the great Corrie to the next peak—that of Crois, 2,785 feet in height, a mountain of very imposing aspect as viewed from Inveruglas, where its steep northern face is seen in bold profile. This effect is lost in the view from Glen Loin, where it appears only as the culmination of the long ridge from Narnain. The summit of Crois is mostly grassy, and does not afford much in the way of rock-ledges or cliffs, except on its southern side, where there is a large rock-face with sloping ledges, rather rich in the less common hill plants.

Ben Ime, the most westerly of these peaks, is highest in altitude, its summit being 3,318 feet above sea-level. On its most easily accessible sides this mountain is grassy to the summit, with little in the way of broken ground to favour the growth of the rarer alpine plants. This is its aspect both from Glen Croe, and from Coiregrogain, and, as its distance from Arrochar renders the peak rather inaccessible, it has, until quite recently, been regarded as a somewhat barren hill. A number of our members, however, have made one or two excursions to the north-eastern side of the summit, which is very different in character, being very steep and rocky; and, although this is perhaps the least explored part of the district, the results of our searches have been already very encouraging, and it seems certain that further work in this region would add considerably to the list of plants recorded.

Ben Vane is a rocky mountain, 3,004 feet high, with a steep southern face towards Coiregrogain, and sloping more gradually toward the north. Nothing of outstanding interest is known to occur upon this peak, but its rock-ledges afford shelter to many of the most interesting plants of the district, and, perhaps, its most attractive feature is that the special haunts of these plants are more

widely distributed over the slopes of this hill, than is the case with any of the other peaks.

Ben Vorlich, the most northerly of our six mountains, covers a larger area than any of the others, and from its picturesque appearance, and the variety of its vegetation, is a most attractive hunting ground for the enthusiast in alpine natural history. Its proximity to Loch Lomond, and its easy accessibility from Ardlui, probably accounts for the fact that it appears to have received more attention from the older workers than any other hill of the group. Indeed, this mountain is the only one, apart from Ben Lomond and Goat Fell, which is specially mentioned in connection with the records of rare alpine species in the "Clydesdale Flora." Its summit attains an altitude of 3,092 feet, and its eastern side is cut into by several deep gullies, richly wooded in the lower part, and sheltering in their upper portions, at a high elevation, several of the most interesting plants of the district. The western side, sloping very steeply toward Loch Sloy, also has many features of botanical interest. Although, as has been said, Ben Vorlich was well explored by the older Clydesdale botanists, it has, of late years, been somewhat neglected, probably from the impression that nothing new is to be expected here. That this is, in all probability, a mistake, is indicated by the fact that in July of this year (1905), Mr. M'Lean and I, in an all too-hurried exploration of the hill, were able to add, at least, one species not before recorded from its recesses.

The present list of the flora of this district does not profess completeness, even as regards the commoner plants. I have included all the species actually observed growing in the district, so far as the fact has been noted. As, however, most of the observations have been specially directed towards the recording of the rarer plants, and as the excursions have been largely confined to the early spring and mid-summer seasons, many plants have probably been omitted which may be even abundant in the district. This, doubtless, accounts for the absence of many common species from the list, as for example, *Galium cruciatum*, *G. verum*, species of *Myosotis*, &c.

With regard to the commoner plants of the district, considerable trouble has been taken to ascertain the altitudinal range of the species upon these hills, and to distinguish between the plants

which ascend the mountains and those which are confined to the lowland areas. In a large number of cases the limits of altitude have been determined, and, in all such cases, the highest point at which the species was observed is given; and, in the case of alpine species, the lowest limit as well. It must, however, be carefully borne in mind that these limits apply only to the hills specified, and may not, in any one instance, agree with the altitudinal range of the species in other localities. I am aware that questions of altitude are apt to be dealt with erroneously when attention is confined to a single district, and, more especially, when the locality selected is of so restricted an area as the one we are dealing with; but, in order to a wider generalisation, it is of importance that the facts with regard to definite localities should be accurately ascertained, and from this point of view our present figures may not be without value.

With reference to the vexed question of the definition of the word "alpine" as applied to plant forms, I may explain that throughout this list I have used the term to signify a plant which, *as regards these particular mountains*, is confined to the higher altitudes, not descending below 1,000 feet. It will be seen that this does not in all cases correspond with the applicability of the term in other localities. There are some species which are frequently found at lower elevations in different parts of the country, but which are here characterized as "alpine" from their occurring in the Arrochar district only on the higher parts of the hills.

In the compilation of the list I have made use of all the material to which I have been able to obtain access. In the great majority of cases, the species has been gathered by myself in the locality indicated; in other instances I have given the source from which the information is derived. I would take this opportunity of expressing my indebtedness to those members of the Society whose notes have been freely placed at my disposal, for their valuable assistance in making the list as complete as possible. Doubtless there are many important omissions, and I shall be greatly pleased if the present paper is instrumental in bringing to light any further information at present unrecorded.

I have to acknowledge, in particular, my indebtedness to Mr. P. Ewing, for his invaluable assistance with some of the larger critical groups, such as *Hieracium*, *Salix*, and *Carex*.

THALICTRUM ALPINUM, L.

Alpine.—Frequent in moist parts amongst grass, near springs, and by the side of the streams. Occurs on each of the six mountains, extending upwards from about 1,200 feet, and attaining an altitude of 2,900 feet on Ben Ime.

ANEMONE NEMOROSA, L.

A characteristic plant of the mountain streams, especially in shady places at a moderate elevation, where it attains great luxuriance. Ascends to 2,600 feet on Ben Narnain.

RANUNCULUS FLAMMULA, L.

Common in marshy places throughout the district, ascending to 2,000 feet on Ben Arthur.

RANUNCULUS ACRIS, L.

Common throughout the district, and attaining great luxuriance in the alpine pastures, especially in wet places at a high elevation. Ascends to 3,000 feet on Ben Ime.

RANUNCULUS REPENS, L.

Roadsides and borders of fields, mostly in the low ground, but ascending the hills to some distance. Noted at 1,400 feet on Ben Narnain.

RANUNCULUS FICARIA, L.

Probably common in the district, but not observed on account of its early-flowering period. Noted on Ben Vorlich at 900 feet.

CALTHA PALUSTRIS, L.

Marshes, and occasionally near springs on the mountains. Ascends to 2,500 feet on Ben Arthur.

TROLLIUS EUROPÆUS, L.

Common on the banks of streams, especially in parts of the Allt-Sugach, where it is very luxuriant. The species, however, does not appear to ascend to high elevations, the greatest altitude noted being 1,800 feet on Ben Vane.

CORYDALIS CLAVICULATA, D.C.

Banks of Loch Lomond at Taret.

NASTURTIUM OFFICINALE, R.Br.

Common in ditches and watery places. Ascends to 2,900 feet on Ben Ime.

CARDAMINE PRATENSIS, L.

Frequent throughout the district, and ascending the hills to some distance. At a moderate elevation it is a not uncommon plant of the rock ledges. Noted at 2,000 feet on Crois.

CARDAMINE HIRSUTA, L.

Very abundant on walls and banks around Arrochar and Tarbet. Ascends to 1,000 feet on Ben Vorlich.

COCHLEARIA OFFICINALIS, L.

On the shore, near the mouth of the Glen Loin burn. Not abundant.

COCHLEARIA ALPINA, Wats.

Alpine, and confined to high altitudes, not descending below 2,000 feet. This is a sub-species (perhaps merely an alpine form) of *C. officinalis*, L., differing from the sea-shore plant principally in the shape of the pods, which are oblong and narrowed at both ends, instead of being almost globose as in that plant. *C. alpina* is fairly abundant on the Arrochar peaks, though not growing on the actual summit in any instance. The highest altitude noted is 3,000 feet on Ben Ime.

SISYMBRIUM OFFICINALE, Scop.

On waste ground near the shore, at Arrochar.

CAPSELLA BURSA-PASTORIS, Moench.

Roadsides and edges of fields; not ascending.

VIOLA PALUSTRIS, L.

Very common all over the district, and at all altitudes, attaining over 3,300 feet on the summit of Ben Ime. This violet is a characteristic plant of moist alpine pastures, especially at a high elevation. It occurs also in wet meadows associated with *Juncus acutiflorus*, and beds of *Eriophorum*.

VIOLA SYLVATICA, Fries.

Common in woods, along the banks of streams, and on rock-ledge. Ascends to 2,700 feet on Ben Arthur.

POLYGALA VULGARIS, L.

Common on the moors, ascending to 2,000 feet on Ben Arthur and Ben Narnain. Both the blue and white-flowered varieties are common throughout the district. The red-flowered form is frequent also, but mostly at a low elevation.

SILENE ACAULIS, L.

Alpine.—Frequent, and generally distributed over the higher parts of the mountains, where it forms dense, cushion-like patches in open, sunny situations. Its lower limit of altitude appears to be about 1,800 feet, at which elevation it was noted on Crois. It ascends to 3,000 feet on Ben Ime and Ben Vorlich.

LYCHNIS DIURNA, Sibth.

Abundant in the woods in Glen Loin, and common in other parts. This plant occurs also, but not abundantly, on the alpine ledges, ascending to 2,700 feet on Ben Arthur.

LYCHNIS FLOS-CUCULI, L.

Wet meadows in Glen Loin, abundant.

CERASTIUM VULGATUM, L.

Roadside near Succoth farm. Apparently uncommon in the district.

CERASTIUM VISCOSUM, L.

Abundant throughout the district. Ascending to 2,900 feet on Ben Ime.

CERASTIUM ALPINUM, L.

Recorded in the first appendix to the "Clydesdale Flora" from Ben Vorlich, upon which mountain I found it in 1892, but did not take note of the altitude. Mr. M'Lean and I gathered it last year on Ben Ime at 2,800 feet. So far, these appear to be the only records for this species on these hills.

STELLARIA MEDIA, Vill.

Cultivated fields and roadsides. Low ground only.

STELLARIA HOLOSTEA, L.

In woods and bushy places. Not ascending to high elevations.

STELLARIA GRAMINEA, L.

Bushy places, common. Ascends to 1,000 feet on Ben Arthur.

STELLARIA ULIGINOSA, Murr.

Bogs, and wet places, especially abundant near mountain springs. Ascends to 2,600 feet on Ben Ime.

CHERLERIA SEDOIDES, L.

Recorded in the "Clydesdale Flora" (App. II.) from Ben Vorlich.

SAGINA PROCUMBENS, L.

Dry banks, rocks and walls. Abundant in the low ground.

MONTIA FONTANA, L.

In springs and rills. Ascending to 2,300 feet on Ben Narnain.

HYPERICUM ANDROSÆMUM, L.

Shady places in Glen Loin, and on the banks of Loch Lomond. Not ascending the hills.

HYPERICUM HUMIFUSUM, L.

Banks and copses, not common. Low ground only.

HYPERICUM PULCHRUM, L.

Very abundant in boggy pastures on the lower slope of the hills. Not ascending to high altitudes.

TILIA VULGARIS, Hayne.

Not common. A number of trees of this species grow on the roadsides near the villages.

LINUM CATHARTICUM, L.

Common amongst grass on the hill-pastures. Ascends to 2,200 feet on Crois.

GERANIUM SYLVATICUM, L.

This is a characteristic plant of mountain streams, growing usually in company with the anemone and the great wood-rush, on shady ledges near waterfalls, etc. It is generally distributed in woodland situations in the district, and ascends to over 2,000 feet. The highest altitude noted is 2,600 feet on Ben Ime.

GERANIUM PRATENSE, L.

Found near Arrochar on the occasion of an excursion of this Society a number of years ago. The species is not common, and does not ascend the hills.

GERANIUM MOLLE, L.

Frequent around Arrochar. Low ground only.

GERANIUM ROBERTIANUM, L.

The herb-Robert, although our commonest geranium in lowland situations, does not appear to be a mountain-loving species. Our only record for the hills is at 800 feet in the woods on Ben Vorlich.

OXALIS ACETOSELLA, L.

The wood-sorrel is a common plant on the mountains, where, in shady places in the crevices of rocks, etc., it usually grows plentifully. Shade appears to be its most essential requirement. The species attains an altitude of 3,000 feet on Ben Ime.

ILEX AQUIFOLIUM, L.

The holly is extensively grown in hedges and gardens in the district, and may be in all cases an introduction. It is, however, perfectly naturalized in many places, and is particularly abundant on the banks of Loch Lomond. On the hills it is not at all uncommon, but usually confined to low elevations. One or two fine specimens, however, were observed by Mr. M'Lean and myself on Ben Ime at an altitude of 2,000 feet. Mr. Herriot informs me that he observed traces of what may be the remains of former habitation near the place where we observed these holly bushes; which may account for their presence in this unusual habitat.

ACER PSEUDO-PLATANUS, L.

Frequent around Arrochar and Tarbet. Not on the hills.

ULEX EUROPEUS, L.

Common on the lower slopes of the hills facing Loch Lomond and Loch Long, but not ascending to high altitudes. There is a very fine "avenue" of gorse bushes on the road near Ardgartan, on the western side of Loch Long. These bushes attain a height of nearly seven feet, and form stems of considerable thickness. Their effect when in full bloom is gorgeous.

CYTISUS SCOPARIUS, Link.

Common in the woods and by streams, at a low altitude. Not ascending.

TRIFOLIUM PRATENSE, L.

Pastures and fields. Ascending to 1,100 feet on Crois.

TRIFOLIUM REPENS, L.

Pastures and fields. Ascending to 1,300 feet on Crois.

LOTUS CORNICULATUS, L.

Abundant in pastures, everywhere. Ascending to 2,300 feet in Corrie Sugach.

LOTUS MAJOR, Sm.

Plentiful in moist places on the roadsides. Low ground only.

VICIA CRACCA, L.

In hedges and bushy places. Low ground only.

VICIA SEPIUM, L.

Bushy places. Low ground only.

LATHYRUS PRATENSIS, L.

Roadsides and borders of fields. Not ascending.

LATHYRUS MACRORRHIZUS, Wimm.

Shady places on the banks of mountain streams, and ledges of cliffs. Ascends to 1,200 feet on Ben Arthur.

PRUNUS SPINOSA, L.

Glen Loin. Low ground only.

PRUNUS AVIUM, L.

Not common. Banks of Loch Lomond.

SPIRÆA ULMARIA, L.

Common near streams, and in wet meadows, ascending the hills to some distance, but not attaining very high altitudes. Noted at 2,200 feet on Crois.

RUBUS IDÆUS, L.

Not common, and apparently confined to the low ground. A specimen was, however, observed on the banks of Allt-a-Bhalachain, at about 700 feet.

RUBUS FRUTICOSUS (*sensu laxo*).

Information is not available regarding the distribution of the various forms of bramble in the district. They all appear, however, to be confined to low elevations, as no member of this group was observed on the hills above 1,000 feet.

RUBUS SAXATILIS, L.

This species is common on the hills, growing in rock-crevices. It is most abundant between 1,000 and 1,500 feet, but specimens were found at 2,300 feet on Ben Vorlich, and at 2,700 feet on Ben Arthur.

RUBUS CHAMÆMORUS, L.

Alpine, and apparently uncommon on the Arrochar mountains, although this species is abundant on the hills between Loch Long and Loch Lomond immediately to the south of the district. Its only records within our bounds at present are, Ben Arthur, 2,200 feet (see Report of a recent excursion of this Society), and Ben Vane, 2,800 feet.

GEUM URBANUM, L.

In woods. Low ground only.

GEUM RIVALE, L.

Common on the banks of mountain streams. Ascends to 2,700 feet on Ben Arthur.

FRAGARIA VESCA, L.

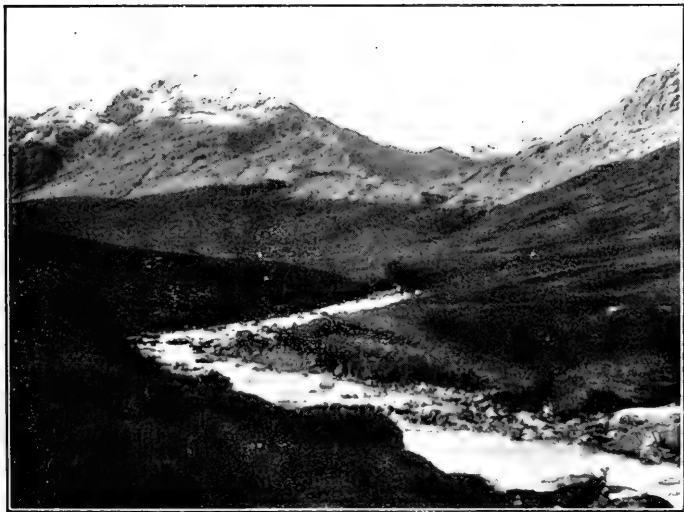
On rocks and banks at low levels. Ascends the slope of Ben Narnain in Allt-Sugach to 400 feet.

POTENTILLA TORMENTILLA, Sibth.

Abundant everywhere, and at all altitudes, growing on all the summits except that of Ben Ime, on which hill it is common except on the very top. This is one of the most characteristic plants of the hill-pastures and moors, but is not confined to the open, as it occurs in abundance also in bushy places, and in woods. Nor does the presence or absence of abundant moisture appear to affect its distribution, for it grows freely both in wet and dry places, although it becomes longer in the stem and more loose in habit when growing in very wet situations.



From Photo. by BEN VORLICH AND LOCH SLOY, FROM *[Robert M'Lean.*
CRUACH-TAIRBEIRT, S.E.



From Photo. by ALLT-COIREGROGAIN AND BEN IME. *[Geo. Herriot.*



POTENTILLA ANSERINA, L.

Roadsides and borders of fields in the low ground, not ascending.

SIBBALDIA PROCUMBENS, L.

Alpine.—Found only at high elevations. Ben Narnain, 2,700 feet; Ben Vorlich, 3,000 feet. Plentiful on both these mountains, but hitherto not recorded elsewhere in the district.

COMARUM PALUSTRE, L.

Moist pastures in Glen Loin.

ALCHEMILLA VULGARIS, L.

Common, and ascending the hills to over 2,000 feet. Noted at 2,700 feet on Ben Arthur.

ALCHEMILLA ALPINA, L.

Very abundant on the higher parts throughout the district, but not strictly alpine, as it descends as low as 650 feet on Crois. On the banks of Loch Sloy it is abundant, and on the slopes of Ben Vorlich above Loch Lomond it was noted at 700 feet. In dry, open situations it forms a dense carpet, to the exclusion of other plants, as on the top of Cruach Tarbet, where it is particularly plentiful. This species occurs on the actual summits of all these hills, except that of Ben Ime, its highest altitude noted on that mountain being 3,000 feet.

ROSA TOMENTOSA, Sm.

Frequent. Low ground only.

ROSA CANINA, L.

All the varieties of dog-rose appear to be strictly lowland. The form *dumalis* appears to be the most common in the district, but information regarding the distribution of the different varieties in this, as in other parts of Clydesdale, is a desideratum.

PYRUS AUCUPARIA, Ehrh.

The rowan attains a higher altitude in the district than any other tree, although, unlike the birch, it never forms woodland. When growing in association with other trees at a low elevation, or in shady gorges of the streams, it frequently attains considerable dimensions; but at higher altitudes it is usually small and stunted. It ascends to 2,700 feet on Ben Arthur.

PYRUS MALUS, L.

The wild apple is common on Loch Lomond side, probably as a relic of former cultivation. A specimen was noted at 400 feet on Ben Vorlich.

CRATÆGUS OXYACANTHA, L.

The hawthorn is common throughout the lower parts of the district, the highest altitude noted being 500 feet on Ben Vorlich.

SAXIFRAGA OPPOSITIFOLIA, L.

Alpine.—Occurring on all the six mountains in the district, Mr. Brown having gathered it this year for the first time on Ben Arthur. It is fairly common on the other peaks from about 2,000 to 2,500 feet altitude, but ascends to 2,700 feet on Ben Vane, and to 3,000 feet on Ben Ime. Below 2,000 feet it becomes rare, but descends as low as 1,500 feet on Crois. Mr. Nisbet reports having seen the species as low as 400 feet in the bed of the Allt-Sugach, evidently washed down by the stream. This, however, is exceptional.

SAXIFRAGA STELLARIS, L.

Alpine.—The most widely distributed saxifrage in Britain, both in altitude and area. This species is usually met with on our hills from about 2,000 feet upwards. It is characteristic of moist crevices of the rocks, especially in the shade, and is also an almost invariable inhabitant of cold springs. It does not usually descend much below 2,000 feet, but was noted at 1,800 feet on Ben Vorlich. It ascends to the tops of the mountains, and was noted on the actual summits of Ben Ime, Ben Vane, and Ben Vorlich.

SAXIFRAGA AIZOIDES, L.

This, although a truly mountain species, is frequently seen growing at low altitudes, sometimes even descending almost to sea-level. Its special habitats are wet rocks, springs, the beds of streams, in the spray of waterfalls, etc. It is common on the Arrochar hills, ascending to 2,800 feet on Ben Ime.

SAXIFRAGA HYPNOIDES, L.

Alpine.—This species appears to be restricted to high altitudes in the Arrochar district, although found at lower elevations elsewhere in the Clyde area. So far the only records for these

mountains are Ben Arthur, 2,300 feet, Ben Ime, 3,000 feet, and Ben Vane, 2,700 feet.

CHRYSOSPLENIUM OPPOSITIFOLIUM, L.

Common on wet rocks and banks, and near springs, throughout the district. Ascends to high altitudes, attaining 3,000 feet on Ben Ime.

PARNASSIA PALUSTRIS, L.

Frequent in marshy places on the mountains. Ascends to 2,200 feet on Ben Ime.

SEDUM RHODIOLA, D.C.

Alpine.—Common on cliffs and rock-ledges from about 1,500 feet upwards. Ascends to 3,000 feet on Ben Ime.

SEDUM ANGLICUM, Huds.

Rocks on the shore, and on the hillsides facing Loch Long. Ascends to 800 feet on Cruach Tarbet.

SEDUM ACRE, L.

Rocks and walls at the head of Loch Long. Does not ascend.

DROSER A ROTUNDIFOLIA, L.

Very abundant on the moors, amongst sphagnum. Ascends to 2,000 feet on Ben Arthur.

MYRIOPHYLLUM SPICATUM, L.

Plentiful in Loch Lomond.

CALLITRICHE VERNA, L.

Ditches on the roadsides.

EPILOBIUM ANGUSTIFOLIUM, L.

Alpine.—Rock-ledges on Ben Vorlich, altitude 2,100 feet.

EPILOBIUM MONTANUM, L.

Common on rocks and banks at low levels, but does not ascend the hills to any considerable extent.

EPILOBIUM TETRAGONUM, L.

Common on the roadsides around Arrochar and Tarbet. Also in Glen Loin, etc. Doubtful forms, apparently referable to this species, or perhaps hybrids with *E. palustre*, are not infrequent, but all confined to the low ground.

EPILOBIUM PALUSTRE, L.

In marshes and wet meadows, general, but nowhere abundant. Typical forms of this species are mostly found on the hills, but occur also in Glen Loin and Glen Croe. It ascends to 2,000 feet on Ben Narnain.

EPILOBIUM ALPINUM, L.

Alpine.—Found on Ben Narnain, Ben Ime, and Ben Vane, and probably occurring also on the other peaks. This species is a common feature of cold springs at a high altitude, but from its small size is probably often overlooked. It may be looked for in rills, etc., from about 2,000 feet upwards, the highest point at which it has been noted in the district being 2,800 feet on Ben Ime.

CIRCEA LUTETIANA, L.

Abundant in the woods in Glen Loin.

SANICULA EUROPÆA, L.

Common in the woods at a low elevation. Noted on the banks of the Allt-a-Bhalachain on the occasion of the Society's excursion in May of this year, but the altitude was not observed.

CARUM VERTICILLATUM, Koch.

Very abundant all over the lower slopes of the hills, and particularly in Glen Croe. This is perhaps the most abundant plant of this order in the district, but does not ascend the hills to any great distance.

ÆGOPodium PODOGRARIA, L.

Noted near Arrochar, but not common.

BUNium FLEXUOSUM, With.

Grass pastures, and on the drier parts of the hills near the base. Ascends to 600 feet on Ben Narnain.

MYRRHIS ODORATA, Scop.

Near Succoth farm in Glen Loin.

ANTHRISCUS SYLVESTRIS, Hoffm.

Hedges and roadsides. Low ground only.

CENANTHE CROCATATA, L.

Shores of Loch Long, and banks of a stream near Succoth.

ANGELICA SYLVESTRIS, L.

Banks of streams and alpine ledges. Common throughout the district. Ascends to 2,200 feet on Crois.

HERACLEUM SPHONDYLIIUM, L.

Common in pastures and fields in the low ground, but does not ascend the hills.

HEDERA HELIX, L.

Trunks of trees and rocks in the shade. The ivy is very abundant wherever the woodland extends, and is occasionally met with climbing the ledges of cliffs on the lower parts of the hills, but does not ascend to high altitudes.

CORNUS SUECICA, L.

Alpine.—I found this species in July of this year at an altitude of 2,200 feet on Ben Vorlich. This appears to be the only record for these hills, unless the entry in the Brit. Ass. Handbook (B, Loch Long, Balfour Ex.) refers to the Arrochar mountains.

VIBURNUM OPULUS, L.

Frequent in the woods on Loch Lomond side.

LONICERA PERICLYMENUM, L.

In woods and bushy places. Common along the banks of the mountain streams. The limits of its altitudinal range have not been determined.

GALIUM BOREALE, L.

A mountain species, but descending to low levels. Noted at 200 feet on the banks of Allt-Sugach. This, however, is perhaps exceptional. This is perhaps the most beautiful of our British bedstraws, and forms a striking object when in full flower on the rock-ledges. It has been found on four of the Arrochar peaks, viz., Ben Narnain, Crois, Ben Vane, and Ben Vorlich, attaining 2,000 feet on the last-named mountain.

GALIUM SAXATILE, L.

The most abundant plant of the hills, growing luxuriantly and flowering profusely at all altitudes, and in every conceivable habitat. Spreading over all parts of the moors, wet and dry—in the recesses of the woods, and on sphagnum bogs—trailing over dry rocks near the seashore, and on the moist humus at the summits of the mountains, the ubiquitous heath-bedstraw carpets the ground everywhere with its dainty clusters of small white flowers and slender trailing stems. Hooker gives 3,700 feet as the altitudinal limit of this species in Britain—a height not attained by any of these mountains. Certainly on the exposed summit of Ben Ime it seems perfectly at home.

GALIUM WITHERINGII, Sm.

Wet places in Glen Loin ; not ascending the hills.

GALIUM APARINE, L.

Roadsides, borders of fields, and hedges ; low ground only.

ASPERULA ODORATA, L.

Frequent in the woods on Loch Lomond side and in Glen Loin. Not observed on the hills.

VALERIANA OFFICINALIS, L.

Common by the side of streams. Altitudinal range not determined.

VALERIANELLA OLITORIA, Poll.

On walls facing the sea at the head of Loch Long.

SCABIOSA SUCCISA, L.

Common on pastures and moors throughout the district, ascending to 2,000 feet on the mountains.

SOLIDAGO CAMBRICA, Huds.

Forms of the golden-rod agreeing most nearly with the description of this species are common on these hills. The differences between this and the type of *S. Virgaurea*, L., however, are not clearly defined. The mountain plant has usually a shorter stem,

the panicle being less branched, and the flower-heads much larger. Low-ground plants, growing on the rocks on Loch Lomond side are frequently taller, but the flower-heads, although less in size than when growing in alpine situations are, so far as I have observed, always larger than those of the type, as we find it, say, on the banks of the Clyde. Distinctions founded upon the serration and ciliation of the leaves appear to be worthless, as the plants are very variable in these respects, the leaves of the same plant frequently differing to a considerable extent. The short-stemmed, large-flowered form common on the rock-ledges at from 1,500 to 2,000 feet, is an exceedingly handsome object. The highest altitude noted for this species is 2,300 feet on Ben Arthur.

BELLIS PERENNIS, L.

The altitudinal range of the daisy is, curiously enough, a point which does not seem to be very satisfactorily determined. The Brit. Ass. Handbook states that it occurs in district "B" up to 600 feet, whilst Hooker (Students' Flora) says, "ascends to near 3,000 feet in the Highlands." This latter altitude is never attained, so far as I am aware, in any part of our western highlands. Last year, I observed the daisy in fine flower on the slope of Ben Arthur above Glen Croe, at an altitude of considerably over 1,000 feet, but the exact height was not noted. This year the highest point at which the species was observed was at 1,300 feet on Ben Vane.

ASTER TRIPOLIUM, L.

Common on the seashore at the head of Loch Long.

ANTENNARIA DIOICA, Br.

Apparently chiefly alpine, but not exclusively so. Ascends to 2,600 feet on Crois. A plant of dry, grassy moors; not common.

GNAPHALIUM SYLVATICUM, L.

Not common. Borders of fields and waste places. Low ground only.

GNAPHALIUM SUPINUM, L.

Alpine, and confined to the stony summits. A characteristic plant of the mountain tops, and very striking in appearance from its white, cottony stems and leaves, and small golden-brown capitula, although its dwarf size renders it rather inconspicuous.

It occurs on all the peaks, and is found on the actual summit of all, except Crois. It does not appear to descend lower than 2,300 feet.

ACHILLEA MILLEFOLIUM, L.

Common in fields and grassy moors at a low elevation only.

ACHILLEA PTARMICA, L.

Sides of fields and near streams, ascending to 600 feet on Ben Vorlich.

CHRYSANTHEMUM LEUCANTHEMUM, L.

Common in fields and pastures. Low ground only.

MATRICARIA INODORA, L.

Waste ground near Arrochar.

TUSSILAGO FARFARA, L.

Not common. Waste ground near the railway station. Not found on the hills.

SENECIO VULGARIS, L.

Ditches and roadsides near the villages, and waste places on the shore. Not ascending the hills.

SENECIO JACOBÆA, L.

Pastures, etc. Low ground only.

SENECIO AQUATICUS, Huds.

Wet places between Arrochar and Tarbet. Not common.

CNICUS LANCEOLATUS, Hoffm.

In pastures, and on open grassy moors. Not found at high altitudes, but limits not determined.

CNICUS PALUSTRIS, Hoffm.

Marshy places and wet meadows. Common. Ascending to about 1,000 feet or perhaps higher. Limits not determined.

CNICUS HETEROPHYLLUS, Willd.

On the side of Ben Vorlich, above Loch Lomond, at about 800 feet; also at 2,300 feet on Crois. Probably occurring elsewhere in the district, but not recorded.

CNICUS ARVENSIS, Hoffm.

Waste ground and dry pastures at a low elevation.

SAUSSUREA ALPINA, D.C.

Alpine, and confined to the rock-ledges. Recorded in the British Association Handbook for Ben Arthur. Found also on Ben Narnain at 2,500 feet, and on Crois at 2,200. These appear to be the only records for the district meantime; but the species may be found in other parts as they become more fully explored. This is one of the most interesting and attractive of our alpine plants.

CENTAUREA NIGRA, L.

Bushy places, sides of streams, and rock-ledges. Ascending the hills some distance, but limits of altitude not determined.

LAPSANA COMMUNIS, L.

Roadsides, etc. Low ground only.

CREPIS VIRENS, L.

Borders of fields and roadsides in the low ground; not ascending the hills.

CREPIS PALUDOSA, Moench.

In woods and shady places beside the mountain streams. Common. This handsome plant is a striking feature of the shady grottoes beside waterfalls, etc., and ascends to a considerable height on the mountains. Noted at 2,300 feet on Ben Arthur.

HIERACIUM PILOSELLA, L.

Banks and pastures at a low elevation. Not ascending the hills.

HIERACIUM HOLOSERICEUM, Back.

Alpine.—On cliffs in Corrie Sugach at 2,500 feet altitude. Also on Ben Vorlich, altitude 2,300 feet.

HIERACIUM CHRYSANTHUM, Back.

Alpine.—A variety, apparently referable to this species, was gathered on Ben Arthur at 2,700 feet; also on Ben Vorlich, 2,000 feet.

HIERACIUM SENESCENS, Back.

Alpine.—Cliffs on Crois, 2,200 feet; Ben Vorlich, 2,300 feet.

HIERACIUM ANGLICUM, Fries.

Common on the banks of the streams at a moderate elevation, and on alpine cliffs. Ascends to 2,300 feet on Ben Vorlich.

HIERACIUM MURORUM, L.

A variety of this species (probably *H. nitidum*, *Back.*) occurs on Ben Vorlich at 2,000 feet. A plant was also gathered on Cruach-Tarbet, apparently identical, at about 900 feet.

HIERACIUM SYLVATICUM, Sm.

A very variable plant. Forms of this species are abundant in the woods and by streams at a low elevation, but do not ascend to high altitudes.

HIERACIUM CROCATUM, Fries.

Reported by Mr. L. Watt from the "head of Loch Long," in the "Clydesdale Flora" (App. II.).—I do not know if this plant was found within our boundaries.

HIERACIUM BOREALE, Fries.

A plant of this species was noted in the woods on Loch Lomond side.

HYPOCHÆRIS RADICATA, L.

Banks, pastures, and sides of streams, also in the woods; very common. This beautiful plant ascends the hills to about 1,000 feet, but the exact limits of altitude have not been noted.

LEONTODON AUTUMNALIS, L.

Common on the moors, particularly so at a high altitude, where it seems rather partial to moisture. Ascending to 3,000 feet on Ben Vorlich.

TARAXACUM OFFICINALE, Web.

The dandelion is fairly common beside the streams, and on the rock-ledges, up to about 2,000 feet. The highest point at which it was noted was at 2,700 feet on Ben Arthur. Both the ordinary form of the plant, and the variety *palustre*, with adpressed involucre, are found on the hills, and occur in similar situations, occasionally even near one another in the same habitat.

LOBELIA DORTMANNA, L.

Very plentiful in Loch Sloy. Recorded also in the "Clydesdale Flora" for Loch Lomond, but locality not given.

CAMPANULA ROTUNDIFOLIA, L.

Common on banks, pastures, and rocks. Ascending to 3,000 feet on Ben Ime.

VACCINIUM VITIS-IDÆA, L.

The cowberry is fairly abundant on the hills, but not common at low levels. From about 1,500 feet upwards it becomes a feature of the rock-flora, usually forming considerable clumps on the drier ledges. It nowhere forms great masses on these mountains, however, extending over a wide area, as is the case on other hills in the Scottish highlands. This species extends upwards to 2,800 feet on Ben Narnain, and almost to the same altitude on Ben Arthur and on Crois, being one of the summit plants on this last-mentioned hill.

VACCINIUM ULIGINOSUM, L.

Alpine.—Plentiful on all the mountains except Crois, where it has not yet been observed. Although its specific name indicates that this is a marsh plant, it is mostly found on rocks in the Arrochar district. It grows, however, in the swamp at the source of Allt-a-Bhalachain on Ben Arthur. It nowhere descends to a low level, the lowest point observed being 1,900 feet on Ben Narnain, and the same on Ben Vorlich. It ascends to 2,600 feet on Ben Narnain.

VACCINIUM MYRTILLUS, L.

The common bilberry is plentiful all over the district, and ascends to the summit of all the mountains, hence attaining over 3,300 feet on Ben Ime.

CALLUNA VULGARIS, Salisb.

The heather occurs pretty generally throughout the district, but does not form true heather-moors except on Cruach-Tarbet, and on the eastern side of Ben Vorlich. These moors do not attain an elevation of more than 1,000 feet, but the species occurs up to 2,000 feet on Ben Arthur and Ben Narnain.

ERICA TETRALIX, L.

Common on the moors up to about 1,000 feet, but not covering large areas except on Cruach-Tarbet.

ERICA CINEREA, L.

Very plentiful in woods and on rocks at a low elevation, particularly so on Loch Lomond side. Not common on the hills, and not ascending to high altitudes.

ARMERIA VULGARIS, Willd.

Alpine.—Apparently confined to the high altitudes in this district, as it does not occur on the shore within our boundary. The following are the only places at which it has hitherto been noted: Ben Arthur, 2,200 feet; Ben Ime, 2,900 feet; Ben Vane, 2,700 feet.

PRIMULA VULGARIS, Huds.

In woods, and beside the streams, common. Ascending to 1,200 feet on Crois.

LYSIMACHIA NEMORUM, L.

Abundant on the hillsides in the lower parts, and ascending to 1,000 feet on Cruach-Tarbet.

GLAUX MARITIMA, L.

On the shore at the head of Loch Long.

FRAXINUS EXCELSIOR, L.

Common in the woods and throughout the low-lying parts of the district, but not ascending to high levels. The ash is a conspicuous feature of the roadside near Arrochar, and one magnificent example is to be seen in front of the Temperance Hotel in the village. This tree is one of the largest of its species in the west of Scotland, and is referred to in Volume I. of the "Annals of the Andersonian Naturalists' Society," page 63.

LIGUSTRUM VULGARE, L.

Frequent in hedges and in the woods, flowering freely. Probably an introduction in all cases.

MENYANTHES TRIFOLIATA, L.

Common in bogs and swampy places. Ascends to 2,100 feet on Ben Arthur.

MYOSOTIS PALUSTRIS, With.

Watery places in Glen Loin.

MYOSOTIS REPENS, Don.

In a ditch in Glen Croe, near the school-house.

MYOSOTIS VERSICOLOR, Reich.

Cultivated fields in Glen Loin.

CALYSTEGIA SEPIUM, Br.

Shores of Loch Long, at Arrochar and Ardgartan.

SCROPHULARIA NODOSA, L.

Common in the woods. Low ground only.

SCROPHULARIA EHRHARTI, Stev.

A single plant of this species, evidently a casual, was found beside some rubbish near the road on the Argyllshire side of Loch Long.

DIGITALIS PURPUREA, L.

Common in woods and bushy places. Ascending to 1,200 feet on Ben Vane.

VERONICA ARVENSIS, L.

Banks and wall-tops around Arrochar and Tarbet. Very abundant. Not ascending the hills.

VERONICA SERPYLLIFOLIA, L.

Ditches and moist places on walls in the low ground.

VERONICA HUMIFUSA, Dicks.

Alpine.—A sub-species, or perhaps merely an alpine form of *V. serpyllifolia*, from which it differs in the much larger flowers and decumbent rooting stems. Found in July of this year on Ben Ime at an altitude of 2,800 feet.

VERONICA OFFICINALIS, L.

Very common on banks and rocks. Ascending to 2,000 feet on Crois.

VERONICA CHAMÆDRYS, L.

Abundant throughout the lower parts of the district, but not ascending the hills.

EUPHRASIA OFFICINALIS, L.

I have not attempted an analysis of the forms of this variable plant. It is very common all over the district, and ascends to 2,500 feet on Ben Arthur.

PEDICULARIS PALUSTRIS, L.

Common in wet pastures and marshes, but mostly confined to the low ground. Ascends to 600 feet on Ben Vorlich.

PEDICULARIS SYLVATICA, L.

Very common on the hills, and ascending to some distance, but limits of altitude not determined.

RHINANTHUS CRISTA-GALLI, L.

Frequent. Altitudinal range not determined.

MELAMPYRUM PRATENSE, L.

Very abundant in the woods on Loch Lomond side. Frequent also in other parts, and ascending to 2,000 feet on Ben Arthur. On the mountains this plant occurs principally amongst rocks in shady situations.

PINGUICULA VULGARIS, L.

In bogs and on wet rocks. Very plentiful. Ascending to 2,300 feet on Ben Arthur.

LYCOPUS EUROPÆUS, L.

Waste ground near the shore at the head of Loch Long.

THYMUS SERPYLLUM, L.

Very abundant on dry banks and rocks all over the district, and ascending to 3,000 feet on Ben Ime.

SCUTELLARIA GALERICULATA, L.

Waste ground at the head of Loch Long.

PRUNELLA VULGARIS, L.

Roadsides and pastures. Ascending to 1,900 feet on Crois.

STACHYS SYLVATICA, L.

Common in bushy places, etc. Ascends to 700 feet on Ben Narnain.

GALEOPSIS VERSICOLOR, Curt.

Cultivated ground in Glen Loin.

GALEOPSIS TETRAHIT, L.

Cultivated fields, Glen Loin.

TEUCRIUM SCORODONIA, L.

This plant is very common on dry rocks in the shade, and in crevices of alpine cliffs. It ascends to a considerable height on the mountains, but its altitudinal limits have not been ascertained.

AJUGA REPTANS, L.

Moist places in the woods and beside the streams. Very common, and ascending to 600 feet on Crois.

PLANTAGO MAJOR, L.

Roadsides, waste places, and borders of fields ; not ascending the hills.

PLANTAGO LANCEOLATA, L.

This is the most abundant species of the genus in the district, and is common all over the hills up to a considerable altitude, but its upper limit has not been ascertained.

PLANTAGO MARITIMA, L.

This species is often found on lofty mountains at a high altitude, but does not appear to be present at great heights on these hills. It is abundant on the slopes of Ben Vorlich near the base.

LITORELLA LACUSTRIS, L.

Shores of Loch Lomond and Loch Sloy ; abundant.

ATRIPLEX BABINGTONII, Woods.

On the seashore at the head of Loch Long.

POLYGONUM AVICULARE, L.

Waste places and borders of fields ; low ground only.

POLYGONUM HYDROPIPER, L.

Common in ditches and watery places. Not on the hills.

POLYGONUM PERSICARIA, L.

Cultivated ground, Glen Loin, etc. Not on the hills.

POLYGONUM LAPATHIFOLIUM, L.

Waste ground near the shore at Arrochar, and in Glen Loin.

POLYGONUM VIVIPARUM, L.

Alpine.—This species is not at all common on these mountains, but occurs on Crois and on Ben Ime, and may probably be found on the other hills. The altitude has not been noted.

OXYRIA RENIFORMIS, Hook.

Alpine.—Very abundant along the watercourses from about 1,500 feet upwards. Ascends to over 2,800 feet on Ben Arthur.

RUMEX OBTUSIFOLIUS, L.

Waste places ; low ground only.

RUMEX CRISPUS, L.

Waste ground, especially near the seashore ; low ground only.

RUMEX ACETOSA, L.

Common everywhere in pastures and alpine moors, ascending to high altitudes. It occurs on the extreme summits of all the hills except Ben Narnain—hence attaining over 3,300 feet on Ben Ime.

RUMEX ACETOSELLA, L.

Dry banks and wall-tops ; low ground only.

MERCURIALIS PERENNIS, L.

In the woods and shady places ; ascending to 1,800 feet on Ben Vane.

URTICA DIOICA, L.

The distribution of the nettle is an interesting problem. It is to be met with on the hills at places where buildings have at one time existed, but does not spread beyond these. Its limits seem to be determined by the operations of man.

MYRICA GALE, L.

Abundant all along the bases of the mountains, but not ascending. In one or two localities this shrub attains great luxuriance, as is the case, in particular, near the base of Ben Vorlich above



BEN ARTHUR AND BEN NARNAIN, FROM SOUTH-EAST.



From Photos, by]

SUMMIT OF BEN NARNAIN, FROM
NORTH-EAST.

[Geo. Herriot,



Inveruglas, where the bushes grow to a height of about four feet, and form a dense growth several acres in extent, to the exclusion of other plants.

BETULA ALBA, L.

Very common all over the lower parts of the hills, except in Glen Croe, which is mostly treeless. The birch becomes dominant, and forms an almost pure woodland at altitudes above the limit of the oak-woods. It is an eminently social species, single, isolated trees being rarely found at any great distance from the rest. The birch-woods attain their highest altitude on Ben Vorlich, the upper limit being 1,500 feet.

ALNUS GLUTINOSA, Gærtn.

Very abundant on the banks of Loch Lomond, and common in the woods elsewhere. Groves of alder occur here and there on the hillsides, notably on Crois above Coiregrogain. These, however, are nowhere of great extent. The species attains an altitude of 1,000 feet on Ben Vorlich.

CARPINUS BETULUS, L.

A tree of this species was noted on the banks of the Glen Loin burn.

CORYLUS AVELLANA, L.

Common in the woods, at low elevations, chiefly associated with oak and alder. Ascends to 600 feet on Ben Vorlich.

QUERCUS ROBUR, L.

The dominant tree in the natural woods on Loch Lomond side. Although mostly in the form of "scrub," there are occasional fine specimens of oaks to be seen in the district. This tree does not ascend to high altitudes on these hills, the upper limit being about 1,000 feet.

CASTANEA SATIVA, Mill.

A few specimens occur on the banks of the Glen Loin burn above the bridge at Arrochar—evidently introduced.

FAGUS SYLVATICA, L.

Common in the Loch Lomond woods, and on the hillside behind Arrochar. Not on the mountains.

SALIX CAPREA, L.

Woods on Loch Lomond side. Not ascending.

SALIX CINEREA, L.

Very common. Ascending to 2,000 feet on Ben Arthur.

SALIX AURITA, L.

Frequent on the hills in moist parts. Ascends to 1,000 feet on Ben Arthur.

SALIX (ARBUSCULA, L.?)

Two small shrubs were found by Mr. M'Lean and myself, of similar habit, with dark shining foliage, one on the banks of the Allt-a-Bhalachain at 1,800 feet altitude, the other on the Allt-Sugach at 1,500 feet. Both plants were females, and in fruit, the capsules being similar in the two cases, but there are slight differences in the form of the leaves. They appear to approach *S. arbuscula* in character, and may be referable to that species, or perhaps to hybrids with *S. nigricans* or *S. phyllicifolia*.

SALIX HERBACEA, L.

Alpine.—A characteristic plant of the mountain tops, where it grows in some abundance on the bare ground, with branches buried in the soil. It occurs on all the summits except Ben Ime, on which hill it ascends to over 3,000 feet. Its lower limit of altitude appears to be about 2,400 feet, but one specimen was found on Ben Narnain at 1,500 feet. This, however, is altogether exceptional. A form with large leaves occurs on Ben Narnain at 2,500 feet, which Mr. Ewing informs me is believed to be a hybrid with *S. Myrsinites*.

POPULUS TREMULA, L.

Frequent in the woods on Loch Lomond side. Ascends to 1,000 feet on Ben Vorlich.

EMPETRUM NIGRUM, L.

Alpine.—Common from about 1,100 feet upwards. Ascending to the summits of Ben Narnain and Crois, thus attaining over 3,000 feet on the former. This shrub is characteristic of peat moors, especially on the drier parts.

JUNIPERUS NANA, Willd.

Alpine.—Rocks and stony places at an altitude of about 2,000 to 2,500 feet. This plant has been found on four of these hills, viz., Ben Arthur, 2,000 feet; Ben Narnain, 1,900 to 2,500 feet; Crois, 2,200 feet; Ben Vane, 2,500 feet.

PINUS SYLVESTRIS, L.

Frequent in the woods and on the hillside behind Arrochar, but nowhere abundant, and never forming pure coniferous woodland. The pine is not found at a high altitude in the district.

MALAXIS PALUDOSA, Sw.

In the "Clydesdale Flora" this species is mentioned as occurring "near the head of Loch Lomond;" and, in the British Association Handbook, Ben Vorlich is given as a station. These two records are probably identical, but I do not know whether this rare orchid has been found in recent years in the locality indicated.

LISTERA CORDATA, R. Br.

In a shady part of the woods near the head of Glen Loin. Very abundant.

ORCHIS MACULATA, L.

Very abundant in marshy places throughout the district, and ascending to 2,200 feet on Ben Arthur.

GYMNADENIA CONOPSEA, Br.

Common near the base of the mountains on the Argyllshire side of Loch Long, and in Glen Croe. Frequent in other parts also, but not ascending.

HABENARIA ALBIDA, Br.

On the moors near Coiregrogain.

HABENARIA BIFOLIA, Br.

In Glen Loin. Both this and the preceding species are probably frequent in the district, but unrecorded.

HABENARIA CHLORANTHA, Bab.

In Glen Loin. Low ground only.

IRIS PSEUD-ACORUS, L.

Marshes at the head of Loch Long. Not on the hills.

ALLIUM URSINUM, L.

Woods in Glen Loin, abundant. Not ascending the hills.

SCILLA NUTANS, Sm.

Common in the woods, and amongst bracken. Occasionally found on the hills, but limits of altitude not determined.

NARTHECIUM OSSIFRAGUM, Huds.

This beautiful plant is one of the great ornaments of our moist hillsides in early summer. It is particularly abundant in all parts of the Arrochar district wherever the ground is marshy, and ascends the hills to a considerable distance, attaining an altitude of over 2,000 feet on Ben Ime.

JUNCUS BUFONIUS, L.

An annual plant, appearing late in summer, and in great abundance on the sandy roadsides, especially in Glen Croe. Not found on the hills.

JUNCUS TRIFIDUS, Koch.

Alpine.—Forming tufts on the rock-ledges at a high elevation, where it is a rather striking object in spite of its small size. Altitude from 2,000 to 2,300 feet.

JUNCUS SQUARROSUS, L.

Very abundant on the hill pastures, and extending from a little above sea level to over 2,800 feet on Ben Arthur.

JUNCUS GERARDI, Loisel.

In salt marshes on the shores of Loch Long. Abundant.

JUNCUS TENUIS, Willd.

This interesting species was found on the roadside near the head of Loch Long in July this year.

JUNCUS COMMUNIS, Meyer.

Abundant in pastures and on the hillsides at a low elevation, but chiefly confined to the dry parts. Altitudinal range not determined.

JUNCUS ACUTIFLORUS, Ehrh.

Very abundant on the hillsides, and becoming dominant in wet places. The presence of this rush in great numbers is an almost certain indication of swampy ground, and as the plant is a rather conspicuous object, this fact is a useful one to bear in mind in crossing the moors. It ascends to near 2,000 feet, but the altitudinal limits have not been ascertained.

JUNCUS LAMPROCARPUS, Ehrh.

In similar situations with *J. acutiflorus*, but not forming such extensive masses, and not ascending so high.

JUNCUS ULIGINOSUS, Sibth.

Common in the bogs throughout the district, ascending to over 2,000 feet on the mountains. It is very abundant in the swamp at the source of the Allt-a-Bhalachain on Ben Arthur.

JUNCUS TRIGLUMIS, L.

Alpine.—In boggy ground at a high elevation. Found on the following peaks:—Ben Arthur, 2,300 feet; Ben Narnain, 2,300 feet; Ben Ime, 2,800 feet; Ben Vorlich, 2,600 feet.

LUZULA VERNALIS, D.C.

Common in the woods and by mountain streams. Ascends to 1,000 feet on Cruach-Tarbet.

LUZULA MAXIMA, D.C.

Very luxuriant in shady places and near waterfalls on the mountain streams; also forming clumps in dry places in the open at high altitudes. Ascends to over 2,000 feet on Ben Narnain.

LUZULA SPICATA, D.C.

Alpine.—Frequent in rocky places at high altitudes, not descending below 2,000 feet. One of the summit plants on Ben Vane, altitude, 3,000 feet.

LUZULA CAMPESTRIS, D.C.

Very common on moorland pastures at all altitudes in the district, ascending to 3,000 feet on Ben Narnain. The variety *erecta* equally common with the type.

TRIGLOCHIN PALUSTRE, L.

In wet pastures, ascending to 700 feet on Ben Vane.

TRIGLOCHIN MARITIMUM, L.

On the shore at the head of Loch Long.

POTAMOGETON NATANS, L. (?).

What I take to be this species grows in great abundance in Loch Sloy. A pondweed (the same ?) also occurs in the Allt-a-Bhalachain near its source at 2,000 feet altitude on Ben Arthur.

ELEOCHARIS PALUSTRIS, Br.

Abundant in Loch Sloy.

SCIRPUS CÆSPITOSUS, L.

Abundant on the hill pastures, and sometimes becoming dominant in drier parts. Ascends to 2,800 feet on Ben Arthur.

SCIRPUS MARITIMUS, L.

Marshes on the shore at the head of Loch Long.

ERIOPHORUM VAGINATUM, L.

Moist places on peat, common. Ascends to 2,500 feet on Ben Vane.

ERIOPHORUM ANGUSTIFOLIUM, Roth.

Distribution similar to *E. vaginatum*, and often found in company with that species. On wet patches in peat-hags, this cotton-grass sometimes forms beds of considerable size. Ascends to 2,500 feet on Ben Vane.

RHYNCHOSPORA ALBA, Vahl.

This plant occurs in great quantity in swampy ground near the base of Ben Vorlich above Loch Lomond; also on the west side of Loch Long. Not found at high altitudes.

CAREX DIOICA, L.

Ben Vorlich; altitude not noted.

CAREX PULICARIS, L.

Common near the base of the mountains.

CAREX ECHINATA, Murr.

Very common in marshy ground. Abundant in the swamp between Ben Arthur and Ben Narnain ; altitude, 2,100 feet.

CAREX OVALIS, Good.

Very common in moist places in the low ground.

CAREX RIGIDA, Good.

Alpine.—Common at high altitudes, and very abundant on all the summits, thus attaining over 3,300 feet on Ben Ime. Not descending much below 2,000 feet.

CAREX VULGARIS, Fries.

Ben Vane and Ben Vorlich. Probably common elsewhere, but unrecorded.

CAREX PALLESCENS, L.

Ben Vorlich and Ben Narnain ; ascending to 2,000 feet on the latter hill.

CAREX PANICEA, L.

Frequent from about 1,000 feet upwards ; ascending to 2,500 feet on Ben Ime.

CAREX BINERVIS, Sm.

Common in pastures amongst grass. Ascends to 2,500 feet on Ben Vorlich.

CAREX FLAVA, L.

Frequent at a moderate elevation.

CAREX PULLA, Good.

Alpine.—Ben Ime, 2,500 feet ; Ben Vorlich, 2,600 feet.

CAREX AMPULLACEA, Good.

In shallow pools and swamps, abundant. Ascends to 2,300 feet on Ben Vane.

ANTHOXANTHUM ODORATUM, L.

Very common. This is one of the dominant grasses of the hill pasture, and ascends to over 3,000 feet.

ALOPECURUS GENICULATUS, L.

Head of Loch Long, near the shore.

PHLEUM PRATENSE, L.

Glen Loin, in the fields.

AGROSTIS VULGARIS, With.

Abundant in the pastures, and amongst bracken. Not ascending.

DIGRAPHIS ARUNDINACEA, Trin.

Banks of the Glen Loin burn.

DESCHAMPSIA CAESPITOSA, Beauv.

Common in the low ground, and ascending the hills to some distance. This grass is difficult to distinguish in the barren state from *D. alpina*, R. & S., which is perhaps merely an alpine subspecies, and which replaces it at a high altitude. For this reason the upper limit of the present form has not been ascertained.

DESCHAMPSIA ALPINA, R. & S.

Common from about 800 feet upwards, especially on the banks of the streams. Ascends to 3,000 feet on Ben Ime.

DESCHAMPSIA FLEXUOSA, Trin.

Very abundant on the moors. Ascending to over 3,000 feet on Ben Ime.

HOLCUS LANATUS, L.

Common in fields and pastures in the low ground. Not ascending.

ARRHENATHERUM AVENACEUM, Beauv.

Frequent in woods, and shady places near streams. Ascends to 500 feet on Ben Narnain.

TRIODIA DECUMBENS, Beauv.

Dry parts of the hills, frequent. Altitudinal range not ascertained.

CYNOSURUS CRISTATUS, L.

Common in fields in the low ground. Ascends to 500 feet on Ben Narnain.

MOLINIA CÆRULEA, Mönch.

Common on the moors. Ascending to over 3,000 feet.

MELICA NUTANS, L.

This species—a somewhat scarce one in Clydesdale—has been gathered by me on a rock-ledge on Ben Vorlich at an altitude of 1,000 feet. I do not know of its occurrence elsewhere in the district.

DACTYLIS GLOMERATA, L.

Roadsides and fields. Low ground only.

POA ANNUA, L.

Common, and ascending the hills to some distance, but limits not noted.

POA ALPINA, L.

Alpine.—Growing in considerable abundance at about 3,000 feet altitude on Ben Ime, Ben Vane, and Ben Vorlich. Not reported from the other peaks.

POA GLAUCA, Sm.

Specimens were gathered by me on Ben Vorlich this year, but altitude not noted.

POA BALFOURII, Parn.

Gathered on a rock-ledge on Ben Vane; altitude, 1,800 feet.

POA PRATENSIS, L.

Roadsides, etc.; low ground only.

POA TRIVIALIS, L.

Roadsides and waste places; low ground only.

FESTUCA OVINA, L.

Very common everywhere, and ascending to the summits of all the mountains, therefore attaining over 3,300 feet on Ben Ime. The curious viviparous form, characteristic of alpine localities, is very abundant on these hills.

FESTUCA DURIUSCULA, L.

Rock-ledges on Ben Vane; altitude, 1,800 feet.

LOLIUM PERENNE, L.

Roadsides and fields; low ground only.

NARDUS STRICTA, L.

One of the most abundant moorland grasses, and dominant over a large part of the hillsides, forming the characteristic "nardus-moor." It ascends to over 2,000 feet, but the exact limits of altitude have not been ascertained.

HYMENOPHYLLUM TUNBRIDGENSE, Sm.

In the "Clydesdale Flora" this species is mentioned as occurring on the "banks of Loch Lomond at Luss and Tarbet." As I do not know the exact locality of the stations referred to, I am unable to say whether the latter comes within the boundary of the district under consideration.

HYMENOPHYLLUM WILSONI, Hook.

Shady rocks and roots of trees, very common. This fern is plentiful in the wooded parts of the banks of mountain streams. Ascending to 2,500 feet on Ben Arthur.

PTERIS AQUILINA, L.

Dominant over large areas on the hillsides in dry, open situations; also frequent in the woods. The bracken is a conspicuous feature on the hills up to about 1,000 feet, shortly above which altitude it stops rather abruptly, the resulting change in the aspect of the vegetation being quite a striking one. As was pointed out by Watson long ago, this altitudinal limit of the bracken may be said to mark the boundary between the lowland and the alpine flora. The limit, so far as the Arrochar mountains are concerned, may be said to be about 1,200 feet, which is found to be fairly constant by comparison at different points in the district. Here and there, however, it extends, in depressions on the hillsides, to a higher elevation, the highest point noted being 1,600 feet on Ben Narnain.

CRYPTOGRAMME CRISPA, Br.

Alpine.—Very abundant on Ben Narnain, from 2,600 feet to the summit. Also found on Ben Ime, at an altitude of 3,200 feet. Not reported from the other hills.

BLECHNUM BOREALE, Sw.

Common in woods and amongst rocks throughout the district. Ascends to 3,300 feet on Ben Ime.

ASPLENium TRICHOMANES, L.

Common on walls and rocks in shady places at a low elevation.

ASPLENium VIRIDE, Huds.

In the "Clydesdale Flora" this fern is said to be "rare." This remark applies only, however, to lowland districts; for this is one of the commonest ferns on alpine rocks, in the shady crevices of which it takes the place of the more delicate *A. Trichomanes*. The latter becomes rare at about 1,000 feet altitude, from which point the present species is common upwards to a considerable height, ascending to 2,700 feet on Ben Ime.

ASPLENium ADIANTUM-NIGRUM, L.

This fern is apparently uncommon on the Arrochar hills, but may possibly have been overlooked. I have only found it on Ben Vorlich, at an altitude of 1,000 feet.

ATHYRIUM FILIX-FOEMINA, Bernh.

The beautiful lady fern is a common inhabitant of the woods and shady places on the hills, becoming scarcer, however, at high altitudes. Its limits have not been ascertained.

CYSTOPTERIS FRAGILIS, Bernh.

Common in rock-crevices, especially in alpine situations. In dark recesses amongst the rocks, at about 2,500 feet altitude, this fern is one of the commonest species. It ascends to 3,000 feet on Ben Ime.

ASPIDIUM LONCHITIS, Sw.

Alpine.—Recorded in the "Clydesdale Flora" (App. I.) from Ben Vorlich, on which mountain I found it growing last year at 1,800 feet altitude. This appears to be the only recorded station in this district, although the fern occurs on the neighbouring Argyllshire hills to the south and west.

ASPIDIUM LOBATUM, Sw.

Rock-crevices in the woods, and shady recesses of the hills. Ascends to 1,900 feet on Ben Vorlich.

NEPHRODIUM FILIX-MAS, Rich.

Common throughout the low ground in woods, and amongst rocks, etc. Not common on the mountains.

NEPHRODIUM SPINULOSUM, Desv.

Recorded in the "Clydesdale Flora" from the "banks of Loch Lomond near Tarbet."

NEPHRODIUM DILATATUM, Desv.

Of this excessively variable species many forms are found throughout the district. It is very common on the hills, one dwarf variety being specially abundant among the rocks at high altitudes. I can make nothing of the descriptions given of the different forms, none of which seem to correspond with the plants one meets with on the mountains. The species extends to 3,300 feet on Ben Ime.

NEPHRODIUM OREOPTERIS, Desv.

This is one of the most abundant ferns in mountainous districts, especially near streams. It extends upwards to a high altitude, becoming, however, more restricted in numbers and smaller in size in the higher and more exposed parts. In crevices of the rocks near the tops of the mountains it becomes very small, one such dwarf specimen being seen on the extreme summit of Ben Ime, near the cairn—altitude, 3,318 feet.

POLYPODIUM VULGARE, L.

Tree trunks, walls and rock-ledges. Ascending to 2,700 feet on Ben Vane.

POLYPODIUM PHEGOPTERIS, L.

Very common in woods and crevices of rocks. Ascending to 3,200 feet on Ben Ime.

POLYPODIUM DRYOPTERIS, L.

Frequent in shady parts of the woods, and recesses of rocks. Ascends to 2,700 feet on Ben Ime.

POLYPODIUM ALPESTRE, Hoppe.

Alpine, and apparently rare. Recorded from Ben Vorlich by Mr. R. Mackay in Brit. Ass. Handbook. Also found on Ben Narnain by Mr. M'Lean and myself at 2,800 feet altitude, these being the only records from these hills.

BOTRYCHUM LUNARIA, Sw.

The moonwort is known to occur on the hills immediately to the south of Arrochar. So far as I know, the only station at present recorded for the mountains now under consideration is at 2,200 feet on Crois.

EQUISETUM ARVENSE, L.

Cultivated ground and waste places. Glen Loin, etc. Not ascending the hills.

EQUISETUM SYLVATICUM, L.

Frequent in woods and near streams. Ascends to 2,000 feet on Ben Arthur.

EQUISETUM LIMOSUM, L.

Abundant in Loch Sloy. Also found in a small tarn on Ben Vane, altitude 2,300 feet.

LYCOPODIUM CLAVATUM, L.

Not common. On the moors on Ben Vorlich at 900 feet altitude. Also on Ben Arthur and Crois, ascending to 2,600 feet on the latter hill.

LYCOPODIUM ANNOTINUM, L.

Recorded in the "Clydesdale Flora," and in the Brit. Ass. Handbook from Ben Vorlich ; altitude not given.

LYCOPODIUM ALPINUM, L.

Alpine.—Common on stony moors from about 2,000 feet upwards, but descending as low as 1,500 feet on Ben Narnain. This is a characteristic plant of mountain tops. Found on the actual summits of Ben Narnain, Ben Vorlich, and Crois, and ascending to 3,200 feet on Ben Ime.

LYCOPODIUM SELAGO, L.

Frequent on rock-ledges and on the moors from about 900 feet upwards to the top of the mountains. Growing on the extreme summits of all the peaks, except that of Ben Arthur, therefore reaching to over 3,300 feet on Ben Ime.

SELAGINELLA SELAGINOIDES, Gray.

Frequent amongst grass near streams; ascending to 2,800 feet on Ben Narnain.

ISOËTES LACUSTRIS, L.

Recorded in the "Clydesdale Flora" for Loch Lomond, but locality not given.

ISOËTES HYSTRIX, Dur.

An old record by Babington for Ben Vorlich is quoted in the Brit. Ass. Handbook, being the only station reported for the Clyde area. I do not know if this plant has been found recently.

PILULARIA GLOBULIFERA, L.

Recorded for Loch Lomond in the "Clydesdale Flora;" locality not mentioned.

THE LAST OF THE POLLOK WYCH ELMS.

By JOHN BOYD.

(Read 7th April, 1905.)

THE "Pollok Wych Elms" which, for many years, were a feature of the place, were well known to many members of this Society and other lovers of nature; because few who visited Pollok went away without admiring this group of very fine old trees, which stood close by the roadside half-way between the mansion-house and the stables.

So far as is known the group was made up of four specimens of *Ulmus montana* (wych or Scotch elm), but whether there ever were more cannot be certified, as there is no record or history of them further back than 1812. I have often thought, however, judging from the position of the trees that there may have been more originally, and before explaining let me say for the benefit of any who may never have been to Pollok, that the trees in question stood in a line, and it is from the distances they stood apart that I formed the idea of a greater number originally. Away back, many generations ago, I believe that there would be at least seven trees, even if the line was not prolonged at either end, which is also within the bounds of possibility.

There are two photographs here, one showing the group of four and the other the last survivors. On looking at the former it is plainly seen that the trees did not stand at equal distances apart. As a matter of fact the two central trees stood about fifteen feet apart, and the two outside ones about thirty and forty-five feet, respectively, from their nearest neighbours. Now, it is only a matter of conjecture, but withal, quite permissible, to come to the conclusion that, in all probability, those two wider spaces were the sites of one and two trees at some remote time, and thus there would have been a line of seven standing at equal distances, but whether such was really the case is not likely ever to be definitely known. One thing about them which seems almost certain is, that

they were not natural seedlings, but that they were planted on the site where they grew; it seems almost as certain that they were planted with some particular object in view, but what that may have been is even more difficult to surmise than the probable original numbers.

It is, no doubt, very pleasant to travel back in our imagination, seeing visions of saplings, poles, and young trees growing up in entirely different conditions to those with which we are familiar; but meantime we must leave that phase of the subject and speak of them as we actually knew them.

As has already been said, there is no known record of them before 1812, although there is little doubt that they stood in the same position for about three hundred years, and the last two a decade longer. From the date just mentioned to the 12th of February, 1894, there was no change in their number, and little change in their appearance. On the latter date the two outside and largest members of the group were blown down, and shortly afterwards I had the honour to give a few particulars of the fallen monarchs to the members of this Society (see Vol. II., page 5). It is, therefore, with pleasure that again I submit some figures about the last of them, along with some general remarks on their growth and probable life history.

Of the two last survivors there are no measurements on record of an earlier date than 1892, when the members of this Society measured all the trees; and indeed it is only of the largest one that we have any earlier measurements recorded. The first is that given in Strutt's book, the date being 1812, and others were taken at varying intervals from that time. In giving these measurements it is well to remember that comparison is not of much value, as it is not certain that the ground about the trees was always at the same level. Indeed, it is known to have been changed several inches on two occasions within the present generation, and it is possible that in former times it may have undergone similar changes.

The measurements above referred to are as follows:—

In 1812 this tree was 10 feet 10 inches in girth at 5 feet, and 85 feet high.

In 1824 it was 11 feet 10 inches in girth at 5 feet.

In 1836 it was 12 feet in girth at 5 feet, and 90 feet high.

In 1842 it was 12 feet 4 inches in girth at 5 feet.

In 1858 it was 13 feet in girth at 5 feet.

In 1862 it was 13 feet in girth at 5 feet.

In 1892 it was 13 feet 9 inches in girth at 5 feet, and 94 feet high.

It is evident from these figures that these measurements were not all taken at exactly the same point. They were either taken at five feet up on different sides, or the ground-level was changed. The latter was the case in the last measurement, as the ground-level was raised about one foot between 1862 and 1892.

The measurements of the whole group taken in 1892 gave the following results :—

No. 1 at 5 feet was 13 feet 9 inches in girth, and 94 feet high.

No. 2 at 4 feet 2 inches was 11 feet 10 inches in girth.

No. 3 at 3 feet 11½ inches was 12 feet and a ½-inch in girth.

No. 4 at 4 feet 9 inches was 13 feet 1½ inches in girth.

The reason for the circumferences being taken at irregular heights was owing to the abnormal growths peculiar to elms. They had to be measured wherever a circuit of the trunk could be got clear of these knotty excrescences.

The two survivors were again measured in 1899 and 1904. The one measuring 11 feet 10 inches in 1892 was by far the less vigorous tree, and its state of health gradually declined as the years rolled on, until, at last, the foliage in summer was very meagre and the crown very small by the falling of branches through decay. It was not to be wondered at then, that, when measured in 1899, no increase had been made; and again, in 1904, the same tale was repeated, or even exaggerated, because then it was actually half-an-inch less, or 11 feet 9½ inches instead of 11 feet 10 inches, as on the two former occasions. Here we have a nice point raised, namely—Does a standing tree in declining health shrink?—a question which may look ridiculous, but one which will stand investigation, as this was not the only old dying tree in Pollok about which the same peculiarity was recorded last year. In the case before us, however, the variation of half-an-inch may be accounted for by the loss of some of the old cork bark which frequently becomes detached on very old trees of this class, and although there was no trace of such having happened, it would take so little to cause the slight difference that it may have been solely due to that.

When this tree was taken down it was found that the root system was very far gone. The main roots, however, were sound upwards of five or six feet from the base of the stem, but there was an almost entire absence of young fibrous roots. A striking feature was the entire absence of tap-roots, large or small, so that when the tree fell it was as bare on the under-side of the ball as if it had been growing on a flagstone. On cross-cutting the tree it was found almost solid, being but slightly decayed on one side of the heart. The timber, however, was of very little value, as it was both ring and star-shaken.

Through the fall the whole top and limbs were literally broken into firewood, very few pieces being larger than one man could remove, thus making it impossible to measure the entire contents, and only the trunk was measured, with the following results:—

The clear bole was over thirty feet, but there was a quite decided bole of more than double that length, although it was broken across at about fifty feet where it was twenty inches in diameter. The girth was taken at three points, at 12 feet 6 inches, 34 feet, and 47 feet, and measured 10 feet 5 inches, 8 feet 5 inches, and 6 feet respectively, containing, according to commercial measurement, about two hundred and sixty cubic feet, and about three hundred and thirty cubic feet actual contents, and would weigh close upon twelve tons.

In reckoning the age by the concentric layers of wood, the process was comparatively easy until about the two hundredth year. After that, however, the rings became so fine that there was great difficulty in defining them; towards the outside they were uncertain, and when tried with a good lens the structure assumed the appearance of cane rather than wood, there being an entire absence of fibre. Several attempts all resulted about the same, making it from two hundred and ninety-six to two hundred and ninety-eight years old; but I believe it was ten or twelve years older, the difference being due to the fact that for the last twelve years or more it had failed to lay on wood to any appreciable extent, which was proved by comparing certain features of growth in both trees, which will be referred to later on.

The other tree which, in 1892, at 3 feet 11½ inches measured 12 feet ½ inch in circumference, was much more vigorous than its neighbour. Measured again at the same place in 1899 and

1904 it was 12 feet 1 inch and 12 feet $3\frac{1}{2}$ inches respectively. Here again there would appear to be a mistake in measurement, or a variation in height where girthed, but there is neither. The actual cause of this apparent half-inch increase in seven years against two and a half inches in the succeeding five years was due to the loss of bark, or rather, it might be said that the 1892 measurement was exaggerated owing to an unnoticed large piece of bark which came off shortly afterwards.

On rooting out this tree it was found to have a very much healthier root system, there being a considerable number of young roots, and also a number of fresh tap-roots of varying sizes, the latter causing considerable trouble in the operation of uprooting.

It might be worthy to note in passing that this tree was a particular favourite with the starlings. There were several holes near the top in which a number of these birds roosted every night, and as it was dusk before the felling operations were completed, some of the tenants of the top had evidently arrived home and gone to rest, as four dead birds were taken out the next morning, no doubt having been killed by the shock in the fall. The late comers arrived when the tree was being swung backward and forward to loosen it, and, perched on the highest twigs, hung on tenaciously, either enjoying the oscillation or wondering what was wrong with the tree. They stuck to their perch until they felt the tree moving rapidly towards the earth, when they took wing, none too soon, as in another second it was down with a mighty crash, sending a cloud of dust and twigs among the culprits who had deliberately brought about its end. Thus fell the last of the "Pollok Wych Elms," and although it was but for a few short years that they had been familiar objects to me, it was with feelings of regret that I beheld the last one laid low.

When this tree was cross-cut off the root it was found to be solid throughout, but with the same commercial defects in ring and star-shakes as its neighbour. As in the former case, the top was so much broken up that only the trunk was measured. It had an undivided and practically clear bole of thirty-nine feet, where it divided into two. The trunk girthed at 13 feet 6 inches, 10 feet $10\frac{1}{2}$ inches; and at 27 feet, 9 feet 10 inches; and the two tops at four feet above the cleft girthed 7 feet 5 inches and 6 feet respectively. It contained in all, according to

commercial measurement, two hundred and eighty-six cubic feet, and in actual contents about three hundred and seventy cubic feet, and would weigh about thirteen tons.

In reckoning the age from the annual rings the task was not much easier than in the former case, for although it had not ceased growing up to the last, the increment was very little and the rings very close. When it is considered that of late years the average annual increase in circumference was exactly half-an-inch, and the wood formed composed almost entirely of vessels, it is easily understood that the outside rings were rather difficult to follow; but, withal, a fairly accurate estimate was got by successive attempts, which resulted in making it three hundred and six years old. But this tree was cut rather high and about three or four years' growth were lost, which would make it about three hundred and ten years, thus corresponding with the age of the two blown down in 1894, and also with that of the fourth tree (which counted two hundred and ninety-seven), if we admit that it had made nothing since 1892. So that there seems little reason to doubt the statement made earlier, viz., that the trees had stood on the same site for not less than three hundred years, and probably about three hundred and ten years.

Now, with your permission, I will try to picture something of the life-history of these trees, and that not altogether from imagination, although it requires a little exercise of that faculty to assist.

As is well known to everyone, trees—like all other plants—are influenced by their surroundings, but they have a knack of recording within themselves something of what has happened about them, by the regularity or irregularity of the annual rings or layers of wood, and it is from these that I purpose making a few deductions. But before doing so I will endeavour to describe this formation of rings, of which I made a very careful study, in which I found that the two trees showed the very same characteristics. Whatever affected the growth at any particular date showed no variation in the two specimens; thus proving that something had happened to cause the same variation in growth in both trees.

Speaking generally, the trees grew rapidly in early years, but did not form very large rings. When fifty-four years old one was

over twenty-two inches in diameter and the other almost twenty-one, and both made steady progress from that until they were one hundred and twenty years. After that, however, their growth was not vigorous, and judging from their general appearance they would be about their best, from a commercial point of view, between the latter age and one hundred and fifty years.

It is necessary, however, for the purpose in view, to go into details, and I must ask you to imagine you see the cross-section of the trees, and beginning at the pith, move outwards across the annual rings, which are broad and regular until we pass the thirteenth, when suddenly there is a change. The fourteenth is not half the breadth of the preceding layers, and the fifteenth, although improved, is still deficient, but the sixteenth seems to be back to the usual, and each successive layer is regular, with no appreciable variation until we reach the twenty-ninth, which is considerably reduced. This, however, does not continue, and the next year sees the increment up to the original standard, which is continued to the thirty-ninth, when again there is a check, having a marked effect until the forty-fourth, which, however, is again about normal, and the growth continues so for nine or ten years, when there is a series of gradually-decreasing annual rings extending to about the sixtieth. Then there is an improvement, which continues with no further variation until we get to the one hundred and twentieth year, when there is a very sudden and decided falling-off, far too much to be natural, and no proper recovery is made from that point onwards.

It is from these vagaries in growth that I propose tracing something of the life-history of the trees.

We can scarcely picture in our minds the general appearance of the country three hundred years ago; but we can imagine ourselves on the side of a nice, clear stream, where we now have an open sewer styled the "White Cart," which name, no doubt, suited it better when the elms were saplings on its banks. They had only recently been planted along with others, but there is also along the river bank a varying thicket of trees and undergrowth which extends back to or probably beyond the young elms, and affords them shelter which, with the good soil, encourages a rapid growth and clean stems. When about thirteen years old, however, it is quite evident that something

caused a sudden check, but which only affected them for two years. If the trees grew from youth on the same site as that on which we knew them, the check in growth may have been due to two bad seasons; but if our forefathers were in the habit of transplanting trees of some size, it may have been that they were transplanted at this age, as the nature and extent of the variation is very like what would happen through that process.

The steady progress from the sixteenth to the twenty-ninth year indicates an uneventful time, and the diminished growth of the latter year might safely be put down to a bad season or to some digging operations about the trees in the spring when growth was beginning.

Again, at the thirty-ninth year, there is a falling-off, which continues in a decreasing degree until the forty-fourth year. This has the appearance of having been caused by a sudden removal of shelter, and the gradual improvement would be the result either of the surrounding trees, etc., thickening up again, or by the trees getting accustomed to their more open position. In all probability it would be the former, as at the fifty-fourth year a decreasing growth in thickness sets in, which continues for about seven years, indicating that the growing space was becoming more limited, and at the sixteenth year the trees would appear to be somewhat crowded, and instead of growing in diameter would be stretching up very rapidly.

The sudden improvement at this age can no doubt be accounted for by a judicious removal of some of the neighbouring trees, which gave the elms sufficient growing space, but did not remove the shelter altogether, nor expose them to such an extent that the extra light and air had an injurious effect. From this age until they reached one hundred and twenty years there does not appear to have been any marked variation in their progress, but when they reached the latter age there is evidence of something little short of an upheaval occurring, which caused a sudden and severe check, from which they never properly recovered. The explanation I would suggest for this is that probably all the surrounding trees were removed, which would interfere very seriously with the specimens left. What took place at this time cannot be said, but I believe that there was no very great change in their surroundings from that time until we saw them, and this opinion is borne out

by the fact that two sycamores, which stood on the river bank near the elms, and were probably the remnants of a line of trees, were about one hundred and seventy to one hundred and eighty years old when cut this year, showing that they had been planted shortly after the date on which the elms received the sudden check.

In conclusion, let me say that I do not expect that all will agree with my ideas or theories as to the life-history of the venerable old trees which adorned the banks of the Cart. I simply place before you the deductions I have made from the variations of their growth, the dates of which are so remote that it is impossible either to verify or contradict them, even although they may be open to question.

RECORDS OF EXCURSIONS IN ARGYLLSHIRE.

BY ALEXANDER ROSS.

GLEN MASSON AND PUCK'S GLEN.

THE first visit of the Society to Argyllshire was made on 3rd August, 1889, when a large party of members and friends landed at Kilmun. Just beyond the straggling village lies the old churchyard, which contains a burying-place of the Argyll family, and the tower of a collegiate church which once existed there. It is said that a triple row of trees formerly led up to the gateway of the churchyard. Now all that remains is an avenue formed of limes on one side, and on the other, great maples extending for about half the distance of the limes. The explanation of the shortening of the middle row and the disappearance of the outer one seems to be that the present shore road has been cut through the sloping bank on which the trees grew. The great maple nearest the churchyard gate was measured and found to have a girth of 9 feet $7\frac{1}{2}$ inches. Passing Rashfield—a favourite haunt of artists—the party entered Puck's Glen, the Fairy Glen, as it is sometimes called, and, before proceeding far, these apparently fanciful names were found to be fully justified by its romantic character. The glen is of considerable extent, and follows the windings of the stream for about two miles, the rock through which it is cut consisting of highly-contorted and crystalline mica-schists of Silurian formation. At every turn sudden surprises and charming views meet the eye. The natural beauty of the little glen has been much enhanced by the judicious planting of numerous trees and shrubs, among which cotoneasters and conifers were conspicuous. The ascent has been rendered easy by the construction of rustic bridges, and a good footpath which follows the winding of the burn. Ferns grow in abundance, and among those noted were the beech fern (*Polypodium Phegopteris*,

L.), the oak-fern (*P. Dryopteris*, L.), the common prickly shield-fern (*Aspidium aculeatum*, Sw.), and the variety (*A. lobatum*, Presl.). The reed fescue grass (*Festuca sylvatica*, Vill.), a grass rarely met with in Clydesdale, and probably of infrequent occurrence in any part of the United Kingdom, was found growing in the glen. Among other plants collected were sea buckthorn (*Hippophæ Rhamnoides*, L.), tutsan (*Hypericum Androsæmum*, L.), grass of Parnassus (*Parnassia palustris*, L.), golden rod (*Solidago Virgaurea*, L.), and the willow-leaved spiræa (*Spiræa salicifolia*, L.).

On leaving the glen the grounds at Benmore were visited. Here a young tree of the variegated ash-leaved *nequando* and the extensive collection of conifers excited admiration. The rockery yielded *Linnaea borealis*, Gronov., a plant named after the great Swedish botanist, the Cornish heath (*Erica vagans*, L.), and the large-flowered St. John's-wort (*Hypericum calycinum*, L.).

On the afternoon of 12th September, 1890, many members took part in a joint excursion with the Natural History Society of Glasgow to Glen Masson. Ardnadam was reached shortly after three o'clock, and with limited time and ten miles to be covered little could be done in the way of botanising. A sharp walk in very warm weather brought the party to Glen Masson falls. The wonderful effect of the carving power of a small stream was seen here to perfection. The rocks are cut into the most fantastic shapes, and on the sides of the burn are the worn-out hollows of old "pot-holes" whose other halves strewed the bed with rugged boulders. The geologists had barely time to examine this when the party had to turn homeward. Few plants were noted on the way, the seaside plantain (*Plantago maritima*, L.), Highland cudweed (*Gnaphalium sylvaticum*, L.), the shining-fruited jointed rush (*Juncus lamprocarpus*, Ehr.), being all that are recorded. The rowan trees were laden with red berries, and lent an added charm to the autumn afternoon. In Benmore policies a herd of twenty roe deer was seen.

Jointly with the Natural History Society, Benmore was again visited on 27th June, 1896. The party were met by the forester of the estate, and conducted by the Loch Eck road to Puck's Glen. Among the plants observed on this occasion were *Saxifraga Geum*, L., which occurs in great profusion near the entrance and well up the glen, the heart-leaved twayblade (*Listera cordata*,

Br.), the pale carex (*Carex pallescens*, L.), the flea carex (*Carex pulicaris*, L.), and the filmy ferns (*Hymenophyllum tunbridgense*, Sm., and *H. unilaterale*, Willd.). Leaving the glen the party paid a hurried visit to the policies. Specimens of *Picea nobilis*, Doug., loaded with young cones six inches in length, excited much admiration. Among other species observed were:—

ABIES PINSAPO, Boiss.	CRYPTOMERIA JAPONICA, Don.
ABIES ALBA, Mich.	C. JAPONICA, VAR. ELEGANS,
PINUS STROBUS, L.	MASTERS.
PINUS AUSTRIACA, Link.	AURICARIA IMBRICATA, Par.
PINUS SYLVESTRIS, L.	CUPRESSUS MACROCARPA, Hartw.

In the grass near the mansion-house *Hieracium aurantiacum*, L., was plentiful. At Kilmun the evergreen alkanet (*Anchusa semper-virens*, L.), and the sea spleenwort (*Asplenium marinum*, L.) were gathered.

The district at the head of the Holy Loch was visited once more on the Trades' Holiday, 27th August, 1904. On this occasion Benmore estate was reached by way of Glen Masson road, and a rapid walk through the grounds only afforded time for admiring the number and variety of the well-grown conifers bordering the main path. The lower shores of Loch Eck were reached, and on the return journey Puck's Glen was explored. The plants noted include the willow-leaved spiræa (*Spiræa salicifolia*, L.), which was growing in the hedge on the Glen Masson road about a quarter of a mile from the head of the Holy Loch, gipsy-wort (*Lycopus europæus*, L.), and great yellow loosestrife (*Lysimachia vulgaris*, L.), in a swampy copse near the same spot. Some plants of the common twayblade (*Listera ovata*, Br.), with unusually large leaves, were observed near the Benmore lodge gate, just within the fence enclosing the estate. The water-lobelia (*Lobelia Dortmanna*, L.) was plentiful in Loch Eck. Scotch mist, so frequent in the district, put entomological work out of the question in the earlier part of the day, and the absence of sunshine later on made the day almost barren. Among the few flies observed were *Rhypholophus varius*, Mg., and *Leptistilineola*, F., the latter, although not a rare fly, being recorded for the first time for the Clyde area. Two fungi, *Agaricus rutilans*, Schaeff., and *Peziza badia*, Pers., were collected.

The last occasion on which this beautiful region was visited was on the Trades' Holiday, 25th August, 1906. The morning looked very unsettled, but during the journey towards Kilmun the appearance overhead improved, and hopes were entertained that the day might be a brilliant one. On reaching the Holy Loch, however, the view ahead kept continually changing, gleams of sunshine, mist, and showers of rain chasing each other down the glens, lending an ever-varying charm to the landscape, and indicating the variety of weather which might be expected when once the head of the loch was reached. Landing at Kilmun the party proceeded by the shore and the left bank of the Echaig. From the roadside overlooking the long sandy stretches which form the head of the loch a fine view of the myriad gulls haunting this part was got. Black-headed gulls seemed to predominate, though herring gulls were plentiful. Lesser black-backs were fewer, and, still less in number, seemingly scarce indeed, were common gulls. From the bridge crossing the Echaig a walk of an hour's duration along a road, every step of which was of interest, brought the party to the river Masson. Rain, which had been threatening for some time, now began to fall heavily. Notwithstanding this the beautiful road margining the Masson was followed as far as the falls. The weather was certainly favourable for seeing these to advantage, and some time was spent before the party left this charming spot and hurried on through a drenching rain to Benmore policies. Here the pinetum and shrubberies were visited. The climatic conditions of the glens appear to favour the growth of pines, which are met with in great variety and luxuriance. Perhaps the most striking feature is the avenue from the mansion-house to the Loch Eck road, which is formed mainly of magnificent rows of *sequoia*. Branching off from this is an extensive avenue of fine *deodars*. The walnut and tulip trees, found on so many estates, were not wanting here, the green fruit of the former showing among the branches. The shrubbery in front of the glass-houses, where a few minutes were spent, contain many specimens of fine shrubs. The party were particularly struck with three species which were in full flower, namely, *Olearia Haastii*, Hook.; *Desfontanea spinosa*, Ruiz. and Pav.; and *Hypericum moserianum*.

The rain had now ceased, and the remainder of the journey

was pursued under more favourable circumstances. Leaving Benmore the road was crossed, and the path leading to Puck's Glen taken. A long and heavy walk up the hillside, now between avenues of trees, and now with rocks on one side and sloping declivities on the other, tested the powers of the excursionists. Halts were made at suitable places, from which commanding views of the scenery could be had. The hills on each side of the valley are steep, and rise to a height of about 2,000 feet, and for a good way up their slopes are richly wooded. To the north lies Loch Eck embosomed in towering mountains. From it a lovely valley stretches southward, through which the winding Echaig carries its waters to join those of the sea. Further south again stretches the Holy Loch, with many well-known watering places nestling on its shores, while across the firth Knock Hill, near Largs, was plainly discernible. After resting and admiring this scene the party entered Puck's Glen, where the botanists enjoyed themselves. Over sixty species of wild plants were observed, the most noteworthy of which have already been recorded. The day was unfavourable for entomology. The district, however, is an excellent one for the entomologist, and the following rare or uncommon Tipulidae have been taken in it:—

DICRANOMYIA AQUOSA, Ver.	ANISOMERA ÆQUALIS, Lw.
GERANOMYIA UNICOLOR, Hal.	AMALOPIS CLARIPENNIS, Ver.
SYMPLECTA PUNCTIPENNIS,	NEPHROTOMA DORSALIS, F.
Mg.	PACHYRRHINA QUADRIFARIA,
S. STICTICA, Mg.	Mg.
LIMNOPHILA APERTA, Ver.	P. ANNULICORNIS, Mg.
L. BICOLOR, Mg.	TIPULA WINNERTZII, Egg.
L. PUNCTUM, Mg.	T. EXCISA, Schum.
L. SEPIUM, Ver.	T. PRUINOSA, W.
L. LUCORUM, Mg.	T. GIGANTEA, Schrk.

GLEN FINART.

Glen Finart has been visited by the Society on four occasions, the first being on the afternoon of 24th June, 1893. The excursionists landed at Blairmore in fine weather, and a pleasant walk over the four miles of beautiful and varied shore-road brought them to Ardentinnny. Passing through this tiny village, which nestles invitingly among the shadows of its background of rugged hills,

the party proceeded up the glen road, which, at its lower end, commands a fine view of Glen Finart House, with Finart Bay and the blue stretch of Loch Long beyond, pushing itself up between the picturesque lines of the Arrochar hills. On reaching the entrance of the glen it was found that time did not permit of its exploration. Among the plants found were the white and purple varieties of candytuft (*Iberis amara*, L.), the curled cress (*Lepidium sativum*, L.), plants certainly garden escapes, the small convolvulus (*Convolvulus arvensis*, L.), meadow crane's-bill (*Geranium pratense*, L.), skullcap (*Scutellaria galericulata*, L.), tutsan (*Hypericum Androsæmum*, L.), wild carrot (*Daucus Carota*, L.), whorled-caraway (*Carum verticillatum*, Koch.), great butterfly orchis (*Habenaria chlorantha*, Bab.), and black spleenwort (*Asplenium Adiantum-nigrum*, L.).

The second visit was on 1st August, 1896. A small party landed at Ardentinnny and proceeded up Glen Finart. *Hymenophyllum tunbridgense*, Sm., the rarer of the filmy ferns, was the most interesting plant met with. The Scottish filmy fern (*H. unilaterale*, Willd.), the maiden-hair spleenwort (*Asplenium Trichomanes*, L.), and the beech fern (*Polypodium Phegopteris*, L.) were also collected. The other plants seen include the round-leaved sundew (*Drosera rotundifolia*, L.), the grass of Parnassus (*Parnassia palustris*, L.), eye-bright (*Euphrasia officinalis*, L.), and butterwort (*Pinguicula vulgaris*, L.). One moss, *Mnium undulatum*, Hed., was noted.

On 22nd June, 1900, the Society again visited this district. Landing at Ardentinnny about four o'clock in the afternoon, the party were met by an advance guard which had started earlier in the day and had worked round the shore from Blairmore. The first object of interest from a natural history point of view was the horned poppy (*Glaucium luteum*, Scop.), growing freely in the hedge skirting the roadway. Though possibly an escape the plant has managed to establish itself securely in this sheltered nook. The road which traverses the glen rises from the shores of Loch Long to a considerable height among the hills, and thence descends to the shores of Loch Eck. It thus presents an extensively varied field of plant and insect life, from the peculiarly littoral to subalpine forms. Plants observed on this occasion and not already recorded were:—

TROLLIUS EUROPÆUS, L.	SANICULA EUROPÆA, L.
COCHLEARIA OFFICINALIS, L.	VALERIANA OFFICINALIS, L.
VIOLA PALUSTRIS, L.	VACCINIUM MYRTILLUS, L.
V. LUTEA, Huds.	SCROPHULARIA NODOSA, L.
HYPERICUM PULCHRUM, L.	RHINANTHUS CRISTA-GALLI, L.
H. PERFORATUM, L.	RUMEX SANGUINEUS, L.
VICIA CRACCA, L.	MYRICA GALE, L.
CIRCÆA LUTETIANA, L.	ERIOPHORUM ANGUSTIFOLIUM,
MONTIA FONTANA, L.	Roth.
SAXIFRAGA AIZOIDES, L.	

The club-moss (*Lycopodium clavatum*, L.) and a fungus (*Mitrula phalloides*, Grev.) were also gathered.

The entomological section was very successful, and the list of captures shows some gratifying results. The most interesting was *Dolichopeza sylvicola*, Curt., a tipulid, whose white shimmering feet had a peculiarly dazzling effect as the insect went flitting about. The species was very abundant in Glen Finart. The Lepidoptera captured were:—

PIERIS NAPI, L.	EPHYRA PUNCTARIA, L.
VANESSA URTICÆ, L. (numbers of whose caterpillars were also found).	FIDONIA ATOMARIA, L.
ARCTIA MENTHASTRI, W. V.	CÆNONYMPHA PAMPHILUS, L.
	TEPHROSIA BIUNDULARIA, Esp.
	HADENA GLAUCA, Hüb.

The cocoons of *Odonestis potatoria*, L., and *Arctia fuliginosa*, L., and the caterpillar of *Bombyx quercus*, H., were also taken. Among the Coleoptera were:—

CICINDELA CAMPESTRIS, L.	RHAGIUM BIFASCIATUM, F.
	R. INDIGATOR, F.

The Tipulidae captured were:—

DICRANOMYIA CHOREA, Mg.	L. LINEOLELLA, Ver.
RHIPIDIA MACULATA, Mg.	L. NEMORALIS, Mg.
EMPEDA NUBILA, Schum.	PEDICIA RIVOSA, L.
RHYPHOLOPHUS NODULOSUS,	DOLICHOPEZA SYLVICOLA,
Mcq.	Curt.
ERIOPTERA TAENIONOTA, Mg.	TIPULA VARIPENNIS, Mg.
E. FUSCIPENNIS, Mg.	T. GIGANTEA, Schrk.
EPHELIA MARMORATA, Mg.	T. OLERACEA, L.
LIMNOPHILA MEIGENII, Ver.	T. PELIOSTIGMA, Schum.

The ornithologists observed a pair of turnstones (*Streptilas interpres* (Linnæus)) between Blairmore and Ardentinnny; the wood wren (*Phylloscopus sibilatrix* (Bechstein)), which was most abundant in the woods, and the garden warbler (*Sylvia hortensis* (Bechstein)) heard at a point about three miles up Glen Finart.

On the occasion of the last visit to this district, on 9th August, 1902, the weather was very unfavourable and no work was done.

CASTLE TOWARD.

Three visits were made to the policies of Castle Toward. Of the first there is, unfortunately, no record.

The second took place on 20th June, 1896, when the Society, in company with the Natural History Society of Glasgow, spent the afternoon there in favourable weather. The policies and gardens are of considerable extent, and occupy, in close proximity to the sea, a sheltered situation which is particularly well suited for the growth of a great variety of shrubs and trees not usually considered, in many parts of Scotland, hardy enough to flourish in the open air. A number of these in the avenue leading from the lodge gate nearest Toward to the mansion-house were examined with interest. The great variety of form and colour in the leaves of several handsome examples of the Japanese maples (*Acer palmatum*, Thunb.), was specially striking. The Himalayan silver fir (*Abies Webbiana*, Lindl.), with its characteristic robust horizontal branches bearing leaves deep green on the upper and silvery-white on the lower surface, and a well-grown example of the one-leaved ash (*Fraxinus monophylla*, Desf.) arrested attention. On the opposite side of the avenue from the latter, a birch (*Betula alba*, L.), which was conspicuous on account of its great size and from the masses of adventitious growths on its branches, was found to measure 8 feet 1 inch at 2 feet 9 inches from the ground. Further on, at the entrance of a path leading to the gardens, a fine specimen of the western plane (*Platanus occidentalis*, L.) measured 9 feet 5 inches at 1 foot 11 inches from the ground on the west side. Near the gardens some fine clumps of bamboos were growing luxuriantly, and the tall grass-like stems and leaves were in pleasing contrast to the more familiar plants in the neighbourhood. *Mimulus luteus*, L., was well established in a little stream close by. At the end of the path a Norway

maple (*Acer platanoides*, L.) measured 7 feet 10 inches at 2 feet 11 inches from the ground on the west side. The hoary plantain (*Plantago media*, L.), was found on a grassy bank in the vicinity. An interesting specimen of one of the Japanese yews (*Cephalotaxus drupacea*, Sieb. and Zucc.) is worthy of mention. This, like other Japanese yews, grows in a straggling manner, and has leaves over three inches in length and somewhat twisted in shape. Among the introduced species about the garden walls may be mentioned *Magnolia Soulangeana*, French, *Diervilla florida*, Sieb. and Zucc., *Azara macrophylla*, Hook., *Ptelea trifoliata*, L., *Escalonia macrantha*, Hook. and Aru., numerous species of clematis and jessamine. On the lawn near the castle are many conifers mingled with evergreen and deciduous shrubs. Among the former were noted *Abies canadensis*, Mich., *A. Albertiana*, Murr., *A. pinsapo*, Boiss., *Thujopsis dolabrata*, Sieb. and Zucc., *Retinospora plumosa*, Hort., and *R. filifera*, Fowler. *Griselinia littoralis*, Raoul., a beautiful evergreen, and *Olearia Haastii*, Hook., one of the New Zealand daisy trees, were the most attractive of the latter. Some Portugal laurels of great size, and covered abundantly with blossom, excited much admiration. At the rock garden a magnolia measured 3 feet 2 inches at 3 feet 9 inches from the ground on the west side. Along the shore the following plants were observed:—

RAPHANUS MARITIMUS, Sm.	G. PRATENSE, L.
DAUCUS CAROTA, L.	ANTHYLLIS VULNERARIA, L.
LINARIA VULGARIS, Mill.	ORCHIS LATIFOLIA, L.
GERANIUM SYLVATICUM, L.	HABENARIA BIFOLIA, Br.
H. CHLORANTHA, Bab.	

The most interesting incident to the ornithologists was the presence of the chiffchaff (*Phylloscopus rufus* (Bechstein)).

The next excursion to Toward was on 7th September, 1901, and was taken part in by members of the Natural History Society of Glasgow and of the Greenock Natural History Club. The first object of interest within the policies was the old ruined castle, once the seat of the chiefs of the Lamonts. Like many other Scottish castles, it is said to have been visited by Queen Mary, who rode from Dunoon, the castle of which place she had also honoured with her presence.

The variety and fine quality of its timber forms the chief feature of the Castle Toward estate. The late Mr. Kirkman Finlay, who purchased this estate, planted five million trees, covering nine hundred acres, in Dunoon parish, besides thirty acres in the parish of Inverchaolin, into which the lands of Castle Toward extend. Fine examples of nearly all our deciduous trees were seen. Among shrubs the Japanese quince, in fruit, the spindle trees, mahonias, and barberries were conspicuous. After wandering about the grounds the party entered the garden and hot-houses, where a wealth of colouring and delightful perfume regaled the organs of sight and smell. They next visited the modern castle, which stands on a plateau, and is considered one of the finest examples of modern Gothic architecture. It was designed by David Hamilton, who planned the Royal Exchange of Glasgow.

KYLES OF BUTE.

On the 25th August, 1900, the Society visited Colintrave and Loch Ridden. From the pier at Colintrave a walk of about a mile and a half along a road planted on each side with oaks, birch and alders, brought the party to an elevation which commands an extensive view. Southwards, across the Kyles, lies the island of Bute. Right below are the real narrows where the water makes its way between dangerous, low-lying islets. Extending to the north, in all its grandeur, is Loch Ridden, a narrow gulf shut in by rugged and precipitous mountains. Near the entrance to the loch is a small inconspicuous island which recalls the part played by one of the Argylls in the rebellion of 1685. The day was spent working through the plantations and along the shores of Loch Ridden to near Springfield House. The following plants were observed:—

DROSER A ROTUNDIFOLIA, L.	ACHILLEA PTARMICA, L.
LINUM CATHARTICUM, L.	A. MILLEFOLIUM, L.
HYPERICUM ANDROSÆMUM, L.	EUPHRASIA OFFICINALIS, L.
H. QUADRANGULUM, L.	MELAMPYRUM PRATENSE, L.
H. HUMIFUSUM, L.	DIGITALIS PURPUREA, L.
H. PULCHRUM, L.	LYCOPUS EUROPÆUS, L.
GERANIUM DISSECTUM, L.	TEUCRIUM SCORODONIA, L.

EPILOBIUM PARVIFLORUM, Schreb.	GALEOPSIS TETRAHIT, L.
E. MONTANUM, L.	SCUTELLARIA GALERICULATA, L.
LYTHRUM SALICARIA, L.	PRIMULA VULGARIS, L., in flower.
PARNASSIA PALUSTRIS, L.	LYSIMACHIA NEMORUM, L.
HYDROCOTYLE VULGARIS, L.	P. PERSICARIA, L.
GNAPHALIUM SYLVATICUM, L.	POLYGONUM MINUS, Huds.
SOLIDAGO VIRGAUREA, L.	

On the roadside and in the woods one was struck with the great number of ant-hills—the work, probably, of *Formica rufa*, L. The lively little inhabitants were wandering about in all directions, and more than one member of the party suffered from their inquisitiveness. *Lepidoptera* and *hemiptera* were scarce, but the following *tipulidæ* were taken :—

PTYCHOPTERA ALBIMANA, F.	AMALOPIS LITTORALIS, Mg.
LIMNOBIA BIFASCIATA, Schrk.	PEDICIA RIVOSA, L.
L. QUADRINOTATA, Mg.	TIPULA LUTESCENS, F.
RHIPIDIA MACULATA, Mg.	T. CONFUSA, V. de Wulp.
EPHELIA SUBMARMORATA, Ver.	

ARROCHAR HILLS.

In search of fresh ground for their Alpine excursions the Society, on 18th July, 1891, selected Ben Ime (3,318 feet), a hill lying to the north of the “Cobbler,” of whose flora there were no records, as worthy of attack. The party proceeded by Loch Lomond to Tarbet, and thence to the head of Loch Long, from which the ascent was made. At Tarbet rain began to fall heavily, and continued till the excursionists were some way up the hill. The mist then cleared, and the remainder of the climb was made under more favourable circumstances. The route taken followed the course of the Allt-a-Bhalachain, a typical mountain torrent. The watershed to the north of the “Cobbler” was reached, and from that a long grassy slope led to the cairn on the summit of Ben Ime. Here a magnificent view of the surrounding country was got, notwithstanding the somewhat unfavourable atmospheric conditions. The descent was made by the course of the Allt-Coiregrogan into Glen Luing, which opens up into the head of

Loch Long. The latter part of the route yielded by far the best results, most of the Alpine plants being gathered here. A more systematic and prolonged search earlier in the season would have met with greater success.

The plants noted in this and following excursions are all recorded in Mr. Lee's paper, "The Flora of the Arrochar Hills" (*vide* page 80).

On 18th July, 1896, a second visit was paid to the Arrochar district. On this occasion the party began the ascent of Ben Narnain from Succoth farm at the entrance of Glen Luing, and followed the bed of the Succoth burn on the north-east side of the mountain. At an elevation of a little over 1,500 feet the main stream is joined, on the south-west side, by a smaller one which descends from the peak. The course of this tributary was followed from its junction to within a short distance of the summit. From the top the party crossed to the south side of the mountain, and descended a steep rocky slope, strewn with large boulders, to the gully between Ben Narnain and Ben Arthur. The course of the Allt-a-Bhalachain was followed downward for the remainder of the journey. From an elevation of about 1,000 feet upwards the hill was enveloped in a dense mist during the entire day, so that no view was to be had. A continuous rain, and the marshy nature of the ground upon the lower parts of the hill, added to the general discomfort.

All through the marshes, and indeed generally in the Arrochar district, is an abundance of the whorled caraway (*Carum verticillatum*, Koch.), which was the first plant of interest noted. The banks of the stream by which the ascent was made are adorned with a rich variety of common alpine and sub-alpine plants, conspicuous among these being *Sedum Rhodiola*, D.C., *Oxyria digyna*, Hill, *Alchemilla alpina*, L., and *Geranium sylvaticum*, L. The globe flower (*Trollius europæus*, L.) was found abundantly, but was past flowering. The alpine hair-grass, *Deschampsia alpina*, R. and S., is common up to an elevation of nearly 2,000 feet, many plants of this species in a viviparous condition being seen. The alpine meadow-rue (*Thalictrum alpinum*, L.), is frequent along the course of the stream. Near the summit of the mountain the abundance of the fruit of the crow-berry (*Empetrum nigrum*, L.) attracted attention. Here also *Juncus trifidus*, L.,

was observed. The parsley fern (*Cryptogramme crispa*, Br.) was found growing plentifully on the south side of the summit. In the same locality the rare *Vaccinium uliginosum*, L., was found plentiful. The most interesting finds among the mosses were:—*Hyocomium flagellare*, B. and S., *Entosthodon ericetorum*, De Not., *Heterocladium heteropterum*, Bank., and *Pottia Heimii*, Fürnr.

The 25th May, 1905, saw the Society once more investigating the hills of this part of Argyllshire, and once more the weather conditions were unfavourable. In the early portion of the day there were a few blinks of sunshine, but afterwards rain fell more or less throughout the day, and, as mist came down on the hills, it was deemed advisable to confine attention to the "Cobbler," leaving out Ben Ime, whose lower slopes were visible only once during a break in the mist. The route followed was up the lower slopes of Ben Narnain to the corrie between that hill and the "Cobbler," and thence to the summit of the latter. The return journey was made down the course of the Allt-a-Bhalachain. The hill climbers confined their attention mainly to the botanical features. At an elevation of 800 feet a fine bank of *Antennaria dioica*, Gärttn., was found in flower, and in the gorge of the Allt-a-Bhalachain *Sanicula europæa*, L., and *Lathyrus macrorrhizus*, Wimm., were very luxuriant. *Rubus Chamæmoris*, L., was got at 2,200 feet. At 2,500 feet *Hymenophyllum unilaterale*, Willd., and *Lycopodium alpinum*, L., were seen. Some flowers of *Caltha palustris*, L., at this elevation seemed to have their beauty enhanced by their position. *Salix herbacea*, L., was seen coming into leaf near the summit of the mountain. In coming down from Ben Narnain a bush of *Juniperus communis*, L., var. *nana*, Willd., was found, thus extending the range of this shrub.

The following mosses are recorded:—

ANDRÆA PETROPHILA, Ehrh.	AULOCOMNIUM PALUSTRE,
A. ROTHII, W. & M.	Schwgr.
OLIGOTRICHUM INCURVUM,	BREUTELIA ARCUATA, Schp.
Lindb.	BRYUM ALPINUM, Huds. (in fruit).
POLYTRICHUM ALPINUM, L.	FONTINALIS ANTIPYRETICA, L.
DIPHYSCIUM FOLIOSUM, Mohr.	HYCOMIUM FLAGELLARE, B. & S.
HEDWIGIA CILIATA, Ehrh.	HYPNUM OCHRACEUM, Turn.
TRICHOSTOMUM TENUIROSTRE,	H. SARMENTOSUM, Wahl.
Lindb.	HYLOCOMIUM LOREUM, B. & S.

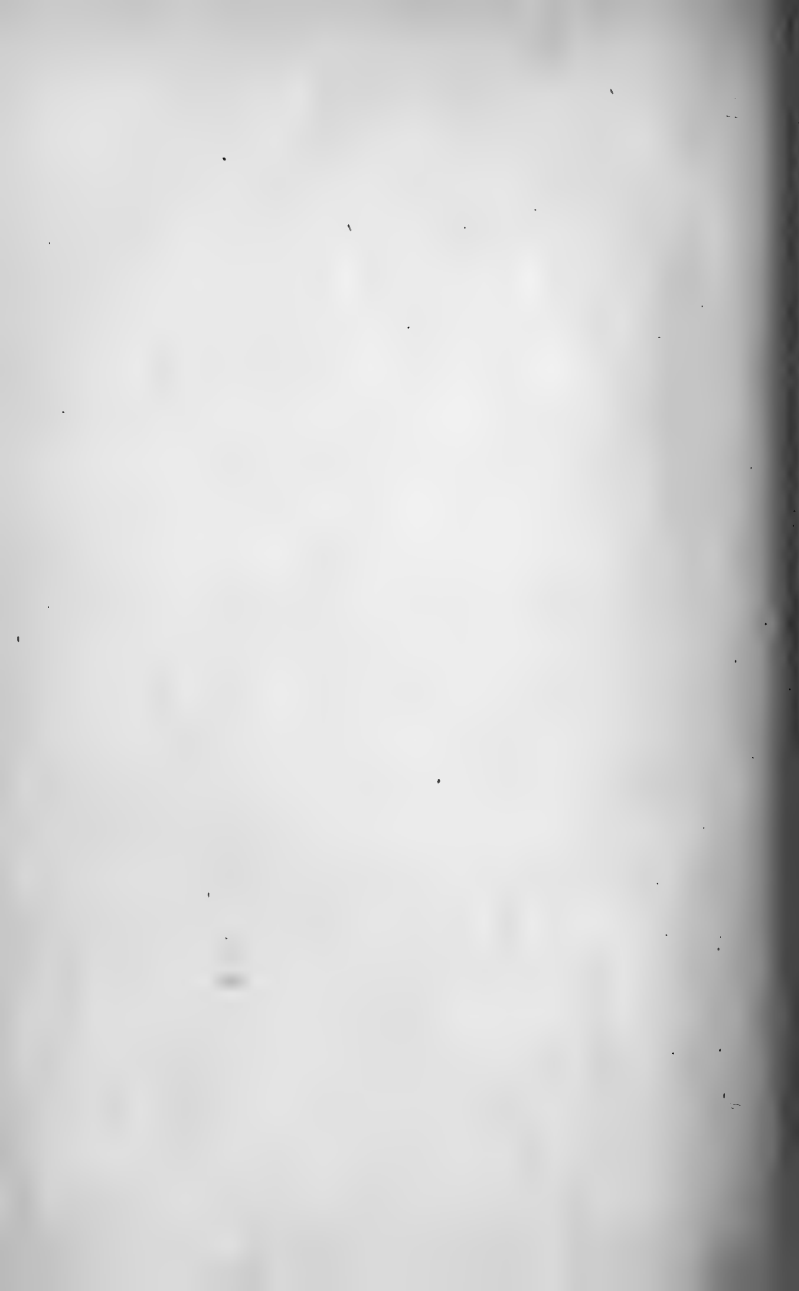
Species of fresh water algae belonging to the genera *Microspora* and *Cladophora* were got in the mountain burns, while in bog pools several species of *Mougeotia*, some in the conjugating stage, were collected.

The ornithologists had the pleasure of seeing the ptarmigan (*Lagopus mutus*, (Montin)) on the "Cobbler." The most interesting of the summer birds observed in the valley were the whinchat (*Pratincola rubetra* (Linnæus)), the wood wren (*Phylloscopus sibilatrix* (Bechstein)), and the tree pipit (*Anthus trivialis* (Linnæus)).

The entomologists confined themselves to the ground on the right bank of the Loin river. Their captures, owing to the state of the weather, were mainly tipulidæ, of which the following are recorded :—

DIXA MACULATA, Mg.	ERIOPTERA TÆNIONOTA, Mg.
LIMNOBIA NEBECULOSA, Mg.	LIMNOPHILA MEIGENII, Ver.
DICRANOMYIA CHOREA, Mg.	L. LINEOLELLA, Ver.
EMPEDA NUBILA, Schum.	AMALOPIS IMMACULATA, Mg.
GONIOMYIA TENELLA, Mg.	DOLICHOPEZA SYLVICOLA, Curl.
MOLOPHILUS BIFILATUS, Ver.	TIPULA RUFINA, Mg.
RHYPHOLOPHUS NODULOSUS,	T. HORTULANA, Mg.
Mcq.	T. PLUMBEA, F.

The hillsides were alive with the last.



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ERRATUM.

Page 78, line 5, for "*Chilosia grossa*" read "*Chilosia grossa* Fallén."

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